

# Popular Science

★ Monthly

FOUNDED  
1872



See Page 51

MARVELS WE MAY SEE IN 1927

JANUARY

By 20 Famous Scientists - Page 20

25 CENTS





## look inside that Christmas Radio Set

**T**HE equipment is as important as the set. The distance reach of a set depends a great deal on the tube in the detector socket. The over-all performance of a set depends very much on the tubes in every socket. The volume and tone quality you will get are dependent upon the tube in the last audio stage. In every point, the tubes are as important as the set. And everyone who realizes this insists on genuine RCA Radiotrons.

The research laboratories of RCA, General Electric and Westinghouse have developed Radiotrons to new accomplishment, year by year. And the manufacturing skill of these same companies keeps RCA Radiotrons far in the lead in accurate making.

*Be sure, when you buy a Christmas radio set, that you are getting genuine RCA Radiotrons with it. You can tell by the RCA mark inside the glass at the top. Or take out the tube, and look at its base.*

### Extra! Extra! Gift Ideas for Radio fans

A "spare" Radiotron—genuine RCA Radiotron, of course—of the type he uses.

A *power* Radiotron UX-112, UX-171 or UX-210 for bigger volume and finer tone.

A special *detector* Radiotron UX-200-A for storage battery sets—for longer distance reach.

Ask any dealer all about these Radiotrons—he'll tell you which to get. But be sure it's a genuine RCA Radiotron, if it's to be worthy of gift giving.

**RADIO CORPORATION  
OF AMERICA**  
New York Chicago  
San Francisco

# RCA Radiotron

MADE BY THE MAKERS OF THE RADIOLA



# Ferguson

**I**N MANY receivers one may experience excellent "tone quality." With **FERGUSON** you are conscious of something more: a degree of fullness that gives you each note from every instrument in perfect timbre. Not mere music, but the soul of the artist seems to come into your living room.

One Tuning Control—Calibrated in Meters gives you, in a moment, the program to suit your mood.

Complete shielding of all tuning elements gives this 6-tube Receiver its marked selectivity.

See, hear, compare!

**J. B. FERGUSON, INC.**

225 West 57th Street  
New York, N.Y.

The **FERGUSON**  
Model Ten . . . . . \$110.00  
With table, as shown, 147.50  
(Ten per cent increase west  
of the Rockies)



No Seasonal Models—  
Continually Developing Refinements

*The Gold Standard of Radio Receivers* ®





# AN IDEA OF YOUR OWN

## AN EDITORIAL

**A** LETTER lies on my desk. It is from a young man in California who wants me to tell him how he can become an inventor. To mind comes a picture of Alexander Graham Bell, white-haired, kindly. A young newspaper reporter had asked him a similar question. The father of the telephone smiled a bit as he pulled slowly on a stubby pipe.

"Young man," he said in words that he weighed as a pharmacist weighs his drugs, "get an idea of your own. Be sure it is a good one. Then put every bit of energy you have into it. And stick to it!"

Think that answer over. "Good advice for anybody, in any walk of life. 'Get an idea of your own!' Get it anywhere. Ideas are as plentiful as dried leaves in the fall, but unfortunately, to most people, are as worthless. Every idea kicked aside may be an invention in the abstract.

A dictating machine that will turn out letters ready for mailing. Window glass that can be seen through from the inside but not from the outside. Untarnishable silverware. A practical machine to utilize the energy in the sun's rays. A regulator that will control instantly the temperature of the water in the bathroom faucets. These are just a few of the challenges to inventive genius to be found on every street, in every home and in every office.

**O**NCE you have your idea, be sure it is good. Utility, practical application, and the satisfying of some human need—these are the yardsticks by which it should be measured. Ask yourself if it extends one of the five senses nature has given us. Will it make our lives broader, easier or happier? If so, the demand is great—in transportation, motion pictures, radio, electric-

ity—in almost every phase of human activity.

But to put behind an idea every bit of energy you are capable of and to stick to it with your whole heart and soul—that takes courage, the quality in human beings that makes for the difference between success and failure.

Mr. Bell faced prejudice and closed minds for years before his telephone was generally accepted. It took courage for George Westinghouse, whose story is told on page 31 of this issue, to stick to his air brake idea after experts told him it was impractical. It took courage for Edison to cling to his incandescent lamp when scientists of repute jeered at the idea. It took courage for Robert Fulton to face the ridicule his steamboat aroused. And it took courage for Henry Ford to laugh when people called him an impractical dreamer. Timidity is about as useful to an inventor as a last year's ice cream soda.

**E**VERY important invention has been confronted on every side by skeptics. People like best the things they know about. A "learned" committee once opposed the construction of a railroad on the ground that an engine in a wagon couldn't work it forward with as much advantage as horses on a road. There were once laws in American communities against bathtubs. People attacked the drivers of our first automobiles. Inventive accomplishment frequently means the ability to face derision fearlessly.

I'm telling that young Californian to listen and think; to examine each idea that comes to him as carefully as a mother examines her first-born. And then, if he chooses an idea the world really needs, and nurtures it with energy and intelligence, he need never worry about the high cost of beefsteak. —S.N.B.



# The new Balkite Combination supplies all radio power automatically from the light socket



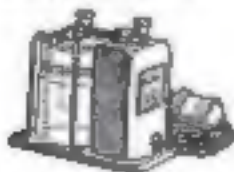
## A New Balkite "B" at \$27.50

Eliminates "B" batteries and supplies "B" current from the light socket. Three new models. Balkite "B"-W at \$27.50 for sets of 5 tubes or less requiring 67 to 90 volts. Balkite "B"-X for sets of 8 tubes or less; capacity 30 milliamperes at 135 volts—\$42. Balkite "B"-Y for any radio set; capacity 40 milliamperes at 135 volts—\$69. (In Canada "B"-W \$39; "B"-X \$59.50; "B"-Y \$96.)



## The New Balkite Charger

MODEL J. Has two rates. A low trickle charge rate and a high rate for rapid charging. Can thus be used either as a trickle or as a high rate charger. Noiseless. Rates with 6-volt battery, 2.5 and .5 amperes; with 4-volt battery, .8 and .2 amperes. Price \$19.50. West of Rockies \$20. (In Canada \$27.50.)



## Balkite Trickle Charger, \$10

MODEL K. With 6-volt "A" batteries can be left on continuous charge thus automatically keeping the battery at full power. With 4-volt batteries can be used as an intermittent charger. Or as a trickle charger if a resistance is added. Rate .5 amperes. Price \$10. West of Rockies \$12.50. (In Canada \$15.)

All Balkite Units operate from 110-120 volt, 50-60 cycle AC. The Balkite Charger is also made in 25-40 cycle model.

Now you can operate your radio set from the light socket. Merely by adding the new Balkite Combination Radio Power Unit. Once connected to your "A" battery and set and plugged into the light socket, it supplies automatic power to both circuits. You need not even turn it off and on, for it is controlled by the filament switch already on your set and is entirely automatic in operation. It will give you a constant quality of reception that cannot be secured in any other way.

Balkite Combination can be installed in a few minutes, either near the set or in a remote location. Like all Balkite Radio Power

Units it has no tubes, nothing to replace or renew, is a permanent piece of equipment, and is built to conform with the standards of the Underwriters' Laboratories. It is noiseless in operation. It will serve any set now using either 4 or 6-volt "A" batteries and requiring up to 30 milliamperes at 135 volts of "B" current—any set of 8 tubes or less, including power tubes.

Add Balkite Combination to your radio set and know the pleasure and convenience of owning a receiver always ready to operate at full power. Price \$59.50. [\$83 in Canada.] Ask your dealer. Fansteel Products Company, Inc., North Chicago, Illinois.

{ Listen to the Balkite Radio Symphony Concerts with Walter Damrosch and the New York Symphony Balkite Hour Saturday Nights 9 P. M. Eastern (8 P. M. Central) Standard Time, over WEA, WEEL, WGR, WFI, WCAE, WSAI, WTAM, WWJ, WGN, WCCO, KSD, WDAF, WOC. }

FANSTEEL  
**Balkite**  
*Radio Power Units*



# Why the Parsons always had the Money to do What They Wanted

By WALLACE AMES, *Financial Editor*

"Among the passengers booked to sail January 10 on the *Marco Polo* for a month's cruise in the West Indies, are Mr. and Mrs. Henry T. Parson."—*News Item*.

"WHY, I can remember," remarked Mrs. Kirk, "when they got married, Bill Parson was just a cub reporter on the *Courier*. He used to solicit classified advertisements on the side. They boarded and Amy kept up her work as stenographer for over a year. And now they seem to be throwing money around."

"I heard that Parson has been made Managing Editor," replied Mr. Kirk. "Guess they are celebrating his new job by blowing in some of the fancy salary he is now drawing."

"Wonder what that trip costs," mused Mrs. Kirk. "Do you suppose we could go, too?"

"Not this year," grumbled her husband. "We still have three more payments to make on the car."

"What gets me," went on Kirk, in a perplexed, somewhat envious manner, "is how the Parsons can afford to do all these things. I don't know what Bill is making, but I always thought I earned as much, or more, yet they have things we can't afford, and they always seem to be well fixed with cash besides."

KIRK was right—in a way—about the Parsons celebrating Bill's rise in business by taking the West Indian Cruise. But Kirk did not know this: They were paying for the trip, not out of salary, but with bond interest.

Kirk was right about another thing—that he had been earning practically the same income as Parson. The reason the Parsons could "have everything" while the Kirks could not wasn't a difference in the earnings of the two men, but a very great difference in the way they managed their money when they got it.

Kirk's point of view was this:

"What can we get with my salary?" And there were always so many things they wanted. Installment buying made it easy to spend the money before it was earned. Even when salary raises came the extra money hardly helped them to get caught up.

The Parsons started their married life on quite a different financial system. They set down three perfectly simple, but very powerful business rules to govern their family finances. 1. Establish a budget and stick to it. 2.

much easier to have some interest coupons coming due about the same time than to have to "dig up" the money.

Or the automobile. That increases the family expense probably \$25 a month or more. With all due respect to the virtues of the motor car, it is a much more virtuous addition to the family if, when it is purchased, bond interest is ready to help take care of the additional expense.

Home buying. A building and loan association or mortgage company will help you finance it. But you must have some money to put in it. And the more cash you have the more liberal the mortgage terms. Today's bond buying program will supply the funds with which to build tomorrow's home.

THE Parsons had the right idea. They used their *earned* income to buy *investment* income. After a few years they were well able to have the many things that the Kirks never could have because the Kirks used all their money to buy everything but more money.

The Kirks actually thought this all out years ago. But at that time they could conveniently save only \$500 or \$1,000 within a year. That meant only \$30 or \$60 interest—a mere drop in the bucket—so they

thought. That is why they followed the premature spending method. And after several years they are still worrying about debts, still bothering their friends with petty borrowing, still looking with envy at the Parsons.

THE things the Parsons went without several years ago make them no unhappier now. They enjoyed themselves even in the days when they were putting a few drops in the bucket every payday. Before they realized it the drops made a whole pailful.

Here is a New Year's resolution for you: *Quit premature spending and begin special purpose investing.*

## HOW TO GET AHEAD

THIS new Department is to help readers in the establishment of proper financial programs at the beginning of their business careers; it assists those who have accumulated money in the proper investment of it so that it will be safe and so that it will grow.

The Editor of this Department is an authority on investment matters and he will not only every month give the readers interesting and useful information in his articles, but is also ready to aid in personal investment problems. Advice will be gladly given regarding the proper investment of funds and proper plans of saving.

Any advertising appearing in this section will be carefully investigated by the Publisher of POPULAR SCIENCE MONTHLY. Readers can be sure that companies advertising are reliable and that they offer securities which represent sound financial investments. While investments obviously cannot be guaranteed by the Publisher, every effort will be made to insure that only advertisements of absolutely reliable companies are accepted.

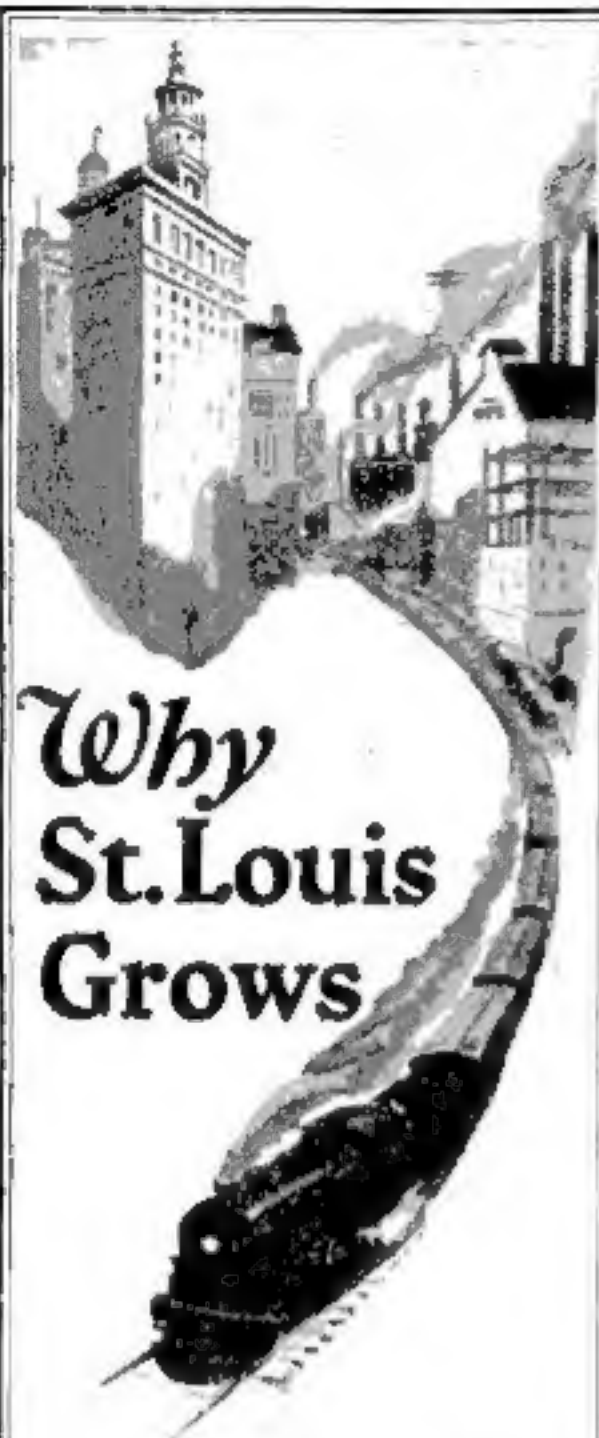
Address letters to: Wallace Ames, *Financial Editor* POPULAR SCIENCE MONTHLY, 250 Fourth Ave., N.Y.

Make saving the first charge in the budget. 3. Postpone luxuries until they can be bought with interest.

Kirk had to earn himself all the money his family spent. Much of the money the Parsons were spending was earned by Bill's investments!

Why not, on January 1, start *Special Purpose Investing*? The principle is as broadly applicable as the needs and desires of man. It works equally well either for periodical expenses or for the indulgences which one hopes to enjoy perhaps once in a lifetime.

Take insurance premiums, income taxes, house repairs and other outlays that come around once a year. How



## Why St. Louis Grows

**T**HERE are adequate "reasons why" for St. Louis' remarkable growth and development. St. Louis has an ideal combination of the chief factors in a successful industrial city and distribution point:

- Central location.
- Nearness to raw materials.
- Fuel, water and power.
- Economical distribution.
- 28 railroads "to everywhere."
- River transportation.
- Satisfactory labor conditions.
- More than 3,300 factories.
- 211 different kinds of industries.

These are some of the reasons why **196 new industries** have come to St. Louis in the last six years. St. Louis manufacturers **Ship From the Center—Not the Rim.** Your factory in St. Louis would have a distinct advantage over competitors not so favorably located.

The complete story is told in our new booklet, "Why St. Louis Grows." Write for it.

Address Dept. 16



**CHAMBER OF COMMERCE**  
ST. LOUIS, U. S. A.

## Financial Booklets Available to Readers

**A**NYONE with money available for investments will find the booklets listed below of help in getting ahead financially. You may obtain any of these booklets by writing direct to the issuing house. It will be appreciated if you will mention **POPULAR SCIENCE MONTHLY** when writing for booklets.

"**How to Build an Independent Income**" presents a modern way of saving money, explains how first mortgage bonds may be purchased by monthly deposits, and presents tables showing results attainable by carrying out their plan. Address: The F. H. Smith Company, 815 15th St., N. W., Washington, D. C.

"**DIVERSIFICATION AND VIGILANCE**" presents a brief analysis of seven basic principles that assure success in the management of personal investments. Address: A. B. Leach & Co., 57 William Street, New York, N. Y.

"**What You Should Know About First Mortgage Bonds**" tells about real estate bonds, their safety and how they will increase your income. Address: Adair Realty & Trust Co., Healey Building, Atlanta, Ga.

"**Forty-Four Years Without Loss to Any Investor**" presents the safety record of this house and describes the safeguards constituting the Straus Plan. Address: S. W. Straus & Co., Desk P, Fifth Avenue & 46th Street, New York, N. Y.

"**Safe Bonds for Investment**" presents their current list of diversified investment offerings, with instructive investment comment. Address: Halsey, Stuart & Co., 201 South La Salle St., Chicago, Ill.

**THE MAKING OF A GOOD INVESTMENT** explains the methods employed by the United States Mortgage Bond Co. in originating first mortgage bond issues which pay 6% with principal and interest guaranteed, or 6 1/2% without the guarantee, which is optional with the investor. Address: United States Mortgage Bond Company, 607 Shelby Street, Detroit, Mich.

**How to Grow and Harvest Dollars** describes a savings-investment plan offered by that Company, and describes how to accumulate from \$4,603.25 to \$46,032.47 by monthly investments of from \$10 to \$100. Address: H. O. Stone & Co., Stone Building, Chicago, Ill.

**AN INVESTMENT INSURED FOR ITS LIFETIME** describes a plan of insured mortgage investments. Nine points of safety are explained. Address: Mortgage Security Company of America, Camp & Canal Streets, New Orleans, La.

**Rules for Safe Investments** explains in language that the layman can understand the important factors of safety of real estate bonds. Address: American Bond & Mortgage Company, 343 Madison Avenue, New York, N. Y.

**Buying Bonds by Mail** explains how the investor may safely and conveniently deal with an investment banker through the mails, and without the usual advantage of direct contact. Address: A. C. Allen and Company, 67 West Monroe Street, Chicago, Ill.

**Your Money** covers the points of general interest to the investor who is planning to put his money in sound mortgage bond investments. Address: Fidelity Bond and Mortgage Co., 39 South La Salle St., Chicago, Ill.

**How to Analyze a First Mortgage Real Estate Bond Issue** is the self-descriptive title of a booklet published by the Federal Bond & Mortgage Co., Griswold & Clifford Avenues, Detroit, Mich.

*Now* **54** *years*

## OF PROVEN SAFETY

Send for anniversary booklet and 1927 edition of "How to Build an Independent Income"

**W**ITH the beginning of 1927, The F. H. Smith Company marks the completion of 54 years of continuous service to first mortgage investors—54 years in which every cent of interest and maturing principal has been paid promptly and in full. Founded in January, 1873, The F. H. Smith Company now has a record of

## No Loss to Any Investor in 54 Years

Our anniversary booklet, "Fifty-four Years of Proven Safety," shows you how this record has been maintained, and how it has created world-wide confidence in Smith Bonds. It explains how every Smith Bond is secured by a first mortgage on modern, income-producing city property. It tells you why men and women in 48 States and in 33 countries and territories abroad have bought Smith Bonds by mail.

For 1927—adopt this plan to invest your monthly savings at **6 1/2%**

The 1927 edition of our booklet, "How to Build an Independent Income," tells how you can buy one or more \$100, \$500 or \$1,000 Smith Bonds by ten equal monthly payments, and how your regular monthly payments earn the full rate of bond interest—6 1/2%. It shows the results you can accomplish by investing \$10, \$20, \$30, \$40, \$50 or more a month at 6 1/2%.

For example, the booklet shows how an investment of \$20 a month, at 6 1/2%, with the interest reinvested at the same rate, grows in 10 years to \$3,370.43; in 20 years to \$9,760.20; in 30 years to \$21,639.46; in 40 years to \$44,395.30. It shows how your money is multiplied over and over again by systematic investment and reinvestment at 6 1/2% interest.

For copies of our two booklets, send your name and address on the form below.

**The F. H. SMITH Co.**

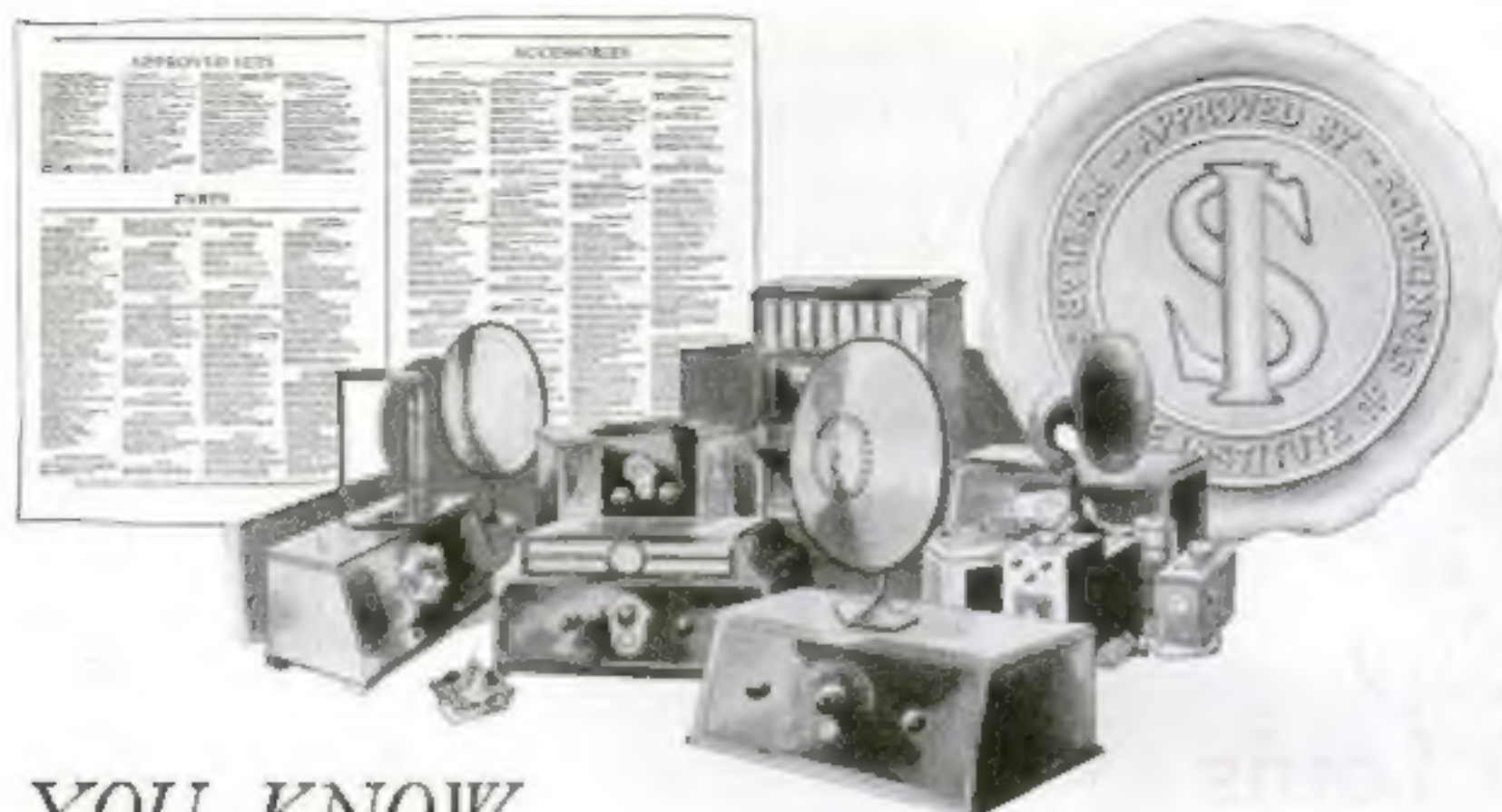
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NEW YORK PITTSBURGH BOSTON PHILADELPHIA  
BUFFALO ALBANY MINNEAPOLIS

Name .....

Address .....





## DO YOU KNOW WHAT RADIO TO BUY?

**A**T THIS season of long winter evenings and Christmas present buying, radio figures prominently in the minds of a lot of people. But, in solving these three problems, it offers a knotty problem all of its own—that is, *what radio apparatus to buy?*

The man who is buying radio equipment these days is exercising a great deal more care than was customary in the first years of radio. There are three perfectly sound reasons for this.

In the first place, he has learned the importance of keeping away from the inferior equipment on the market. Second, he is much more exacting than he was in those early days of radio. And, in the third place, whether he is buying his first set or replacing it, he is usually investing considerably more in a radio receiving outfit than seemed advisable when radio had not become the stable industry it is today.

Buying a \$50 or a \$500 radio outfit becomes an all-serious problem to such a man. But what would he do if confronted with the problem of buying \$50,000 worth of radio equipment a month? He might do the same thing a million-dollar exporting concern did—secure a list of the equipment approved by the Popular Science Institute of Standards and make selections from it.

"We have found it to be good business to buy only radio apparatus that has passed the official tests of the Popular Science Institute. In July, this year, we bought \$50,000 worth of radio

merchandise from your list of approved radio products. Since adopting this policy, we have never had a single complaint from a customer."

This is the statement of Mr. Arthur F. Street, President of R. W. Cameron & Co., Inc., of New York and Australasia. This big exporting firm, rated by Bradstreet's at "a million dollars high," is the American representative of leading radio retailers in all parts of Australasia. It sells American merchandise through branches in Sydney, Melbourne, Brisbane, and Wellington, New Zealand. Behind the firm stands a seventy-four-year record of success.

Not many readers of POPULAR SCIENCE MONTHLY face the buying problem of R. W. Cameron & Co., Inc. Few have

to figure on a 12,000-mile separation from the manufacturer—an important consideration should any equipment prove defective. But the care which this great exporting concern exercises in selecting its radio equipment can well be followed by every radio purchaser. Purchasing 100 percent approved equipment leads to 100 percent satisfaction has been the experience of the thousands who have been guided by the test findings of the Popular Science Institute of Standards.

**M**ORE and more people are taking advantage of the Institute's guidance and help in solving radio buying problems. They hesitate to accept the often biased opinion of a radio dealer, or base their purchases on the somewhat limited experience of friends.

They feel that, in coming to the Popular Science Institute for advice, they are getting the benefit of an extensive and impartial knowledge of radio equipment as a result of laboratory tests made on such products. This is well expressed by a New Jersey reader in a letter received today—

"I am a firm believer in your Institute and feel safe in purchasing approved merchandise; while on the other hand, I would not even consider a set if approval had been withheld or withdrawn."

Readers who are interested in learning what radio equipment (also tools) have the approval of the Institute can secure a list of approved products. Address Popular Science Institute, 250 Fourth Avenue, New York, N. Y.

### Popular Science Monthly GUARANTEE

The above seal on an advertisement indicates that the products referred to have been approved after test by the Popular Science Institute of Standards.

POPULAR SCIENCE MONTHLY guarantees every article of merchandise advertised in its columns. Readers who buy products advertised in POPULAR SCIENCE MONTHLY may expect them to give absolute satisfaction under normal and proper use. Our readers in buying these products are guaranteed this satisfaction by POPULAR SCIENCE MONTHLY. THE PUBLISHERS



# IT Sounds Right!



  
**ALL-AMERICAN**  
**Reproducer**

**A**LL the tones perfectly—that is the result you want for complete enjoyment of your radio. You secure that result with the All-American Reproducer—pure, *natural* tone of voice or instrument; with clearness of highest treble and mellow richness of lowest bass; in perfect uniformity, at full volume or at a whisper.

You get "the best" out of your receiver with this fine instrument. It combines the best features of the two leading principles of reproduction—cone-type and sounding chamber; which explains its accuracy in preserving the naturalness of all tones at any volume.

Price \$25.00 Slightly Higher West of the Rockies

## Socket Power you can depend on

Operate your set from the handiest light socket with All-American "Constant-B" Battery Eliminator.


With the All-American "B" Eliminator you get socket power from a unit that is tested and proved; recognized as a dependable instrument that can't go wrong.

It is made to meet any voltage requirements; five output taps provide steady uniform plate current; two variable controls permit exact regulation of voltages for R. F. and detector stages. A "High-Low" switch assures proper output for all receivers up to ten tubes.

"Constant-B" is compact, attractive; no acid, no hum. Built complete with Raytheon Tube.

Price \$37.50 Slightly Higher West of the Rockies



  
**ALL-AMERICAN**  
**Battery Eliminator**



## New 1927 Radio Key Book

You'll enjoy reading it—48 pages of interesting, up-to-the-minute facts about radio, simply told. Also full construction details of all leading types of circuits. Send 10 cents (coin or stamps) to cover postage and mailing cost.

**ALL-AMERICAN RADIO CORPORATION**

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OWNING AND OPERATING STATION WENR • 266 METERS



# Quality Always Pays

**B**UYING a radio receiver is investing in pleasure, entertainment, information. You get what you pay for. If you want true radio happiness that will endure, then you'll choose a Synchronphase.

For Synchronphase reception is unusually superior because of several Grebe developments: Colortone, Binocular Coils, S-L-F Condensers, Low-Wave Extension Circuits, etc.

If you want to know why they combine to produce such reception as, perhaps, you've never realized was possible,

*Write for Booklet P*

A. H. Grebe & Co., Inc., 109 West 57th St., New York  
 Factory: Richmond Hill, N. Y.  
 Western Branch: 443 So. San Pedro St., Los Angeles, Cal.

The **GREBE**  
**SYNCHROPHASE**

TRADE MARK REG. U. S. PAT. OFF.



TRADE MARK  
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All Grebe  
 apparatus  
 is covered  
 by patents  
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 ing.



This Company owns and  
 operates stations WAHG  
 and WBOQ; also low-  
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 tions, Mobile WGMU and  
 Marine WRMU.

The Grebe Synchronphase is  
 supplied in the standard  
 cabinet model, with and with-  
 out battery base, and in five  
 beautiful console models.

"Good words gain  
 you honor in the  
 market place; but  
 good deeds gain  
 you friends among  
 men."

It is performance  
 that gains the  
 Synchronphase  
 praise and friend-  
 ship from its  
 owner.

*Ernest Miller*





# POPULAR SCIENCE MONTHLY

SUMNER N. BLOSSOM, Editor

January, 1927



Sir Alan Cobham, whose exploits rival in stirring romance any tale of a knight of old. From a drawing by S. J. Ward for the New York Times.

## The World's Greatest SKY Taximan

*A Story of Sir Alan Cobham,  
Who Rides Roaring Winged  
Steeds to Glorious Adventure*

By ROBERT E. MARTIN

AS THIS is written there comes to America a knight who, in fearless conquest and romantic adventure, can match the exploits of any hero who graced the Round Table of King Arthur of old. For coat of mail he has sheathed himself in the helmet and goggles of an aviator. For steaming charger, he rides a roaring winged steed which has carried him to the ends of the earth. For his quest, he seeks not to rescue his maiden from enchanted castle but to bridge the skies above the world, to chart new paths in the air. For enemies he has braved the bullets of savage tribes, the sky-blown sands of the desert, the rocky walls of mountain peaks, and the tempests of the sea. He has even met with gigantic dragons! For pure adventure he once risked his life to peer with glistening eyes into a volcano's smoking crater. In all the length of his travels, added together, would reach more than halfway to the moon!

The name of this hero of modern romance is Sir Alan Cobham, recently knighted by King George of England for his latest and greatest exploit, a 28,000-mile air journey from London to Australia and back again. In this and two previous journeys, one to India and back, another to South Africa and back, he traveled some 60,000 miles—enough to circle the earth twice.

Only seven years ago, Sir Alan was an unknown and all but penniless young "gypsy flier," a war veteran, living a hand-to-mouth existence, picking up

"fares" whenever he could find them. Today he is a Knight Commander of the British Empire, hailed as one of the greatest commercial aviators the world has yet seen; honored by kings, dictators, princes and presidents.

Back in 1919, when Great Britain's war time air forces were demobilized, young Cobham found himself, with 20,000 odd other pilots, walking the streets for a job. A handful of civilian air jobs were to be filled, but none of these was for him. In London he was a stranger.

What Cobham did at that crucial moment was a direct portent of the triumphs of Melbourne and London seven years later. He was not one of the 20,000 who returned from cockpit to office desk with sighs of relief for the regained security. His head may have been in the clouds, as friends told him, but he replied that he felt more at home there!

HE BECAME a chauffeur of the air, a sky taxi driver.

With such small funds as he had left, added to what he could borrow, Cobham bought a secondhand government machine, patched it up, and went to work. Among his first fares were American tourists. He taxed them to Paris, Berlin, Venice and Constantinople; or drove them on short hops to Wales and Scotland.

Two years passed, during which Cobham became known as England's "air

taxi-man." Then followed the first of a series of romantic exploits. A wealthy American engaged him as chauffeur for a ten-thousand-mile aerial joy ride over the countries of Europe. This new patron was Lucian Sharpe, an adventure-loving tool manufacturer of Providence, R. I.

On a flying field at Naples some weeks later, the two men were standing beside Cobham's plane when Sharpe, pointing toward grim Vesuvius smoking menacingly in the distance, exclaimed, "Cobham, let's fly over the crater!"

THE pilot glanced sharply at his employer.

"Do you really mean that? All right, let's go!"

He climbed into the cockpit. Sharpe scrambled in beside him. Soon they were soaring over the city toward the giant smokestack. The American could not have guessed that in the heart of the young pilot there had also lurked a desire to peer into the boiling pit, nor could he have been prepared for the thrill that followed.

No sooner had the plane crossed the rim of the crater than a whirling breath of poisonous gas caught it and with terrific force shot it like a feather a thousand feet in the air.

Choking and dizzy from the fumes, Cobham at first was helpless to control his crazy flight. Then, guided by instinct,





### Thrills That Come to Few

Triumphs reserved for the world's greatest heroes have come to the ex-gipsy flyer Aubrey Cobham. In his plane, the *De Havilland*, he has made the greatest flight from England to Australia, and is now making a new air trail to Cape Town. Air

### Hopping a Hemisphere

The world has been hopping a hemisphere. Aubrey Cobham, the ex-gipsy flyer, has made the greatest flight from England to Australia.



he managed to bring the ship to an even keel just in time to save himself and his passenger from frightful death.

ONCE, while carrying a British general on a 1000-mile flight across Europe to Constantinople, Cobham was enveloped in a blanket of low-hanging clouds in the Alps. Forced down to a height of fifty feet above the Danube river, he wound his way for a hundred miles through the narrow passage between the sheer, jagged cliffs of the famous Iron Gate, which towered a thousand feet on either side. Below them boiled rapids and cataracts. One false move, a single instant of indecision or misjudgment would have crushed them against the rocky walls.

"We didn't have room to turn around," he said later of this close shave. "It was a bit uncomfortable for a time, but we carried on and finally got out."

In these and many other exploits, the young pilot was inspired not so much by love of adventure and personal gain—although flying for hire was his daily bread—as by the hope of achieving a great ambition. That goal was to prove to the world that the airplane could be employed as safely and economically as a railway train or motor car for travel. His ambition was partly realized in the Constantinople trip mentioned above, for when he and his passenger reached Constantinople (in October, 1924) they had covered 1800 miles over some of the most treacherous country in Europe at an average height of less than 100 feet, and without a serious mishap. In shorter flights, likewise, he was able to demonstrate that an airplane could be relied upon to meet emergencies and every demand for speed.

Whenever news photographs needed to be rushed from European cities and from outlying points in the British Isles to meet editions of London newspapers, Cobham was the man who did it. When an American missed his New York steamer at Southampton, Cobham flew him to Cherbourg to catch it. When Steve

Donoghue, the famous English jockey, was in a hurry to get to France to ride in the Deauville races, it was Cobham who picked him up and flew him there.

These, however, were more or less minor achievements. The big opportunities to prove the worth of commercial flying were still to come. In the summer of 1924, Cobham won the King's Cup race over the 930-mile course around Great Britain, defeating nine other planes and completing the course in a little more than nine hours. That same year he was awarded the Britannia Trophy for the greatest achievement of a British aviator during the year—a 12,000-mile flight to the Near East and return, which took him across Africa, Spain and France.

THEN, in the spring of the following year, he completed the first of the three daring long-distance exploits which eventually lifted him to the rank of knight-hood. This was a flight from England to Rangoon in Burmese India and return—a total distance of 17,000 miles—carrying as passenger Gen. Sir Sefton Branker, Director of Civil Aviation in the Air Ministry. His course took him over northern Europe to Constantinople, then to Bagdad, Delhi and Calcutta and across India.

It was in India, during this tour, that Cobham set out on a spectacular attempt to achieve what no man on earth has ever done—reach the top of Mount Everest, the world's highest peak. He had arrived at Calcutta with his passenger when the idea occurred to him.

"General," said Cobham to his companion, "I'd like to have a good look at the Himalayas from the air. Perhaps I can't get over the top of the big one, but I'm going to try."

So, leaving Sir Sefton in Calcutta, he and his mechanic ventured forth. While the attempt failed, the flight had one worth while result. What happened is best described in Cobham's own words.

"I reached an altitude of 17,000 feet," he said, "and was prevented by clouds from rising any farther. But our attempt

was not in vain. Until the clouds started we had the loveliest view one could imagine. We could see clearly for two hundred miles. The flight proved the feasibility of making a complete aerial photographic survey of the Himalayas."

The success of the India trip, for which he was again awarded the Britannia trophy, led Cobham, in November of the same year (1925), to embark on another trail-blazing air voyage. This time from England to Cape Town, at the southern tip of Africa, and return—10,000 miles in all. Although a thousand miles shorter than the previous jaunt, this trip presented far greater perils. Much of the 8,000-mile path was above lands never flown over before. The shifting mountain ranges and dense jungles were dotted by unknown tribes. Most dangerous of all were the terrific heat and the dust storms of tropical Egypt. Anywhere along the route a forced landing might mean the cruelest form of death. Yet when he set out in his plane, the *De Havilland* biplane, Cobham carried only a couple of suitcases for baggage, as if going on a week's pleasure jaunt.

As he sped on, the fury of tropical storms beat against him and drove him from his course. For 2,000 miles steaming jungles made the air so hot that even 5,000 feet up the heat was almost unbearable. Once he had to climb to 7,000 feet to find a temperature as low as ninety degrees in the shade. Once, sandstorms drove him to a height of 15,000 feet. But, in the end, a sky trail to South Africa was marked on the map.

RETURNING to England in March of last year, Cobham had barely rested from this journey when in June he embarked with his veteran mechanic, A. G. Elliott, on the latest and greatest of all his adventures—the 28,000-mile journey to Australia and back, girdling the Eastern Hemisphere.

All England—in fact, most of the world—watched the progress of that amazing flight with tense interest. First Paris was passed, then Naples and Athens. Now the



shers, bridging the Mediterranean, headed across the Arabian desert on the road to Basra, at the head of the Persian Gulf. Then came the shock of tragedy. Elliott, the mechanic, was slain, the victim of a wandering Arab's rifle!

It was a tragedy so amazing and unexpected that at first the English, back home, could hardly believe the news when they read it.

**COBHAM** and Elliott were flying low over the desert, approaching Basra. Below them dwelt roving Arab tribes, notorious for their lawlessness. Desert winds flung up clouds of blinding sand. Suddenly Cobham was startled by a sharp report. He glanced quickly at Elliott. The face of his comrade was deathly white and distorted with agony; he pressed a hand against his breast. What could have happened? Had a bursting gas pipe inflicted the wound? Whatever the cause, Cobham saw there was no time to lose. He opened wide the throttle of his powerful motor and sped toward Basra. There he glided down to the river Shat-el-Arab. Swiftly lifting the mortally wounded man in his arms, he waded to shore, and from there rushed him to a hospital.

A bullet in Elliott's chest and a bullet hole through the fuselage of the plane told what had happened. Some wandering Arab, either through enmity or as a foully hearty prank, had fired a single shot at the plane from below, and by one chance in a thousand the bullet had struck home!

His eyes wet with tears, Cobham buried his friend at Basra. "It is a foul and cruel blow," he wailed home, "probably done by some irresponsible fool who could not do it again if he tried a thousand times." He waited for the arrival of another mechanic, then took up the trail once more. Delhi, Calcutta, Rangoon, Singapore—all were left behind, and at last, with pontoons attached to his ship, he flew out over the islands of the Dutch East Indies.

Again he plunged into adventure so strange and romantic that it might have come straight out of some ancient legend.

**ON THE** little island of Komodo he saw three live dragons—gigantic lizards which, from all appearances, were direct descendants of the prehistoric monsters of mythology. They were ten to twenty feet long, and armed with great claws which enabled them to kill and devour animals as large as horses.

They used their powerful tails as lashing weapons, one blow from which could break a man. In movements they were exceedingly swift. From natives, who lived in mortal terror of the monsters, Cobham learned that the creatures had been known to run down and kill half-wild island ponies, and that they had been seen fighting one another over the carcasses of wild boars.

Two of the dragons, the only ones in captivity, were brought recently to America. One of them died soon after its arrival. Scientists say their dis-

covery and capture constitute one of the most important additions ever made to zoological collections. Rarest of all reptiles, their ancestry dates back 4,000 years, to the time of the pyramids.

Proceeding to Port Darwin, on the northern coast of Australia, Cobham turned his plane southward and flew overland to Melbourne, his destination, where he arrived early in August. There he was greeted with a tremendous welcome. His journey had taken a little more than a month.

The return voyage proved no less exciting. On the way from the island of Penang, off the Malay Peninsula, to Rangoon, Cobham and his plane mysteriously disappeared. For three days the world waited anxiously, fearing disaster. Then, while rescue parties were being organized, there came a message from the pilot that he was safe. He had been trapped, he said, by the most terrific deluge of rain he had ever known. He described the experience:

**"ON FRIDAY** morning we took off at six o'clock with a bad storm coming up behind, but we hoped to get ahead into fine weather before it arrived, and to reach Rangoon, 600 miles away. But after going forty miles we ran into the worst rainstorm I had ever experienced. They simply blanked out all visibility,

so we turned back. To my dismay, I found bad weather had closed in behind us, so we had to fight our way through the deluge. Often it was impossible to go ahead. But at last we reached Victoria Point again, where we landed and moored up just in time before an even greater deluge came down. It almost swamped the boat that came out to assist us. We moored up in a water-pont, and then jumped into a small rowboat and headed toward shore, 150 yards off. We had pulled only a few yards when the seaplane was obliterated from view by a tremendous downpour."

**AFTER** waiting for a break in the weather, Cobham continued the long voyage homeward. In London on the first day of October, just a month from the time he left Australia, and three months after his departure from England, a vast crowd awaited his arrival. As his ship appeared over the rooftops, they gazed down to the waters of the Thames, he was met by a thundering roar of welcome. The crowds, mad with enthusiasm, broke through police lines and overwhelmed him. A few days later he knelt before the King and received the honors of knighthood. He had completed the 28,000-mile air route in 220 hours of flight, at an average speed of 87½ miles an hour.



One Lash of Its Tail Will Kill a Man

The days of romance are not past in a world that still holds gigantic dragons for its young heroes to slay. Above is a type of monster Cobham met with on the island of Komodo.



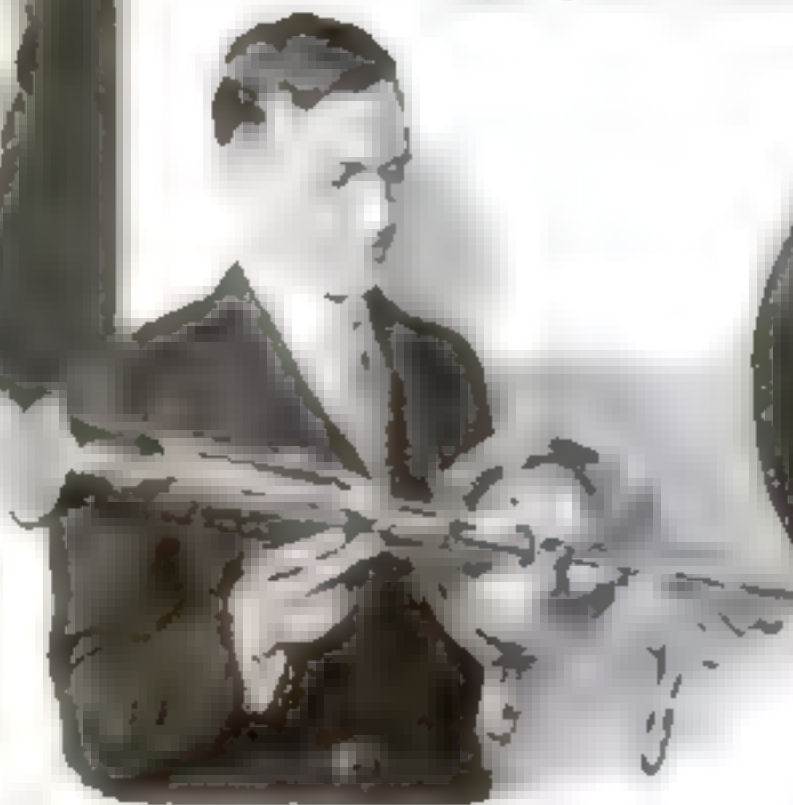
# Atomic Bullets Open Magic New

*Mysterious Cathode Rays Make Rocks Glow, Turn Gas to Yellow Powder, and Kill Germs and Insects*



**The Man Who Did It**

Dr. W. D. Coolidge, assistant director of the research laboratories of the General Electric Company. With his new cathode ray tube, pictured here he summons from the invisible universe of atoms magical streams of power that hold untold possibilities.



**A Spectacular Bombardment**

Remarkable effects of the rays on a crystal of calcite. Bluish white sparks, believed to be electrical explosions, appear beneath the surface. The crystal glows with cold, orange light long after removal from the path of the rays. Center: The Coolidge cathode ray tube.

ONCE again an Aladdin of science rubs his magic lamp and holds the world in wonder. This time he is Dr. William David Coolidge, already famous for his invention of the modern tungsten-powered and portable X ray tubes, and now the creator of an amazing new instrument that may rank with the discovery of the X ray in its importance to mankind—a new tube for the production and use of powerful cathode rays.

With the throw of a switch he summons from the invisible world a mighty stream of mysterious energy which transforms, magically, every object which it touches and brings into being new forms and substances never before seen by man. At his word a pure crystal glows with cold light and flares bluish sparks, the gray face of granite turns brilliant with many colors; colorless gas changes into yellow powder; liquids change into solids; metal takes on a coat of "paint" applied by unseen hands; insects and germs perish instantly.

A slight man, sensitive-faced and sensitive-fingered, wearing big, light-rimmed spectacles, Dr. Coolidge revealed some of these wonders a few weeks ago during the first public demonstration of his new tube before a group of scientists gathered at the Franklin Institute in Philadelphia to honor him for his previous achievements. In the darkened room rested the strange apparatus—a glass tube about a yard long, bulging like a toy balloon at the center, and supported in a maze of wires, coils and insulation. An electric switch was touched. Instantly, with a crackling hum, a ball of purple light, two feet in diameter, hung in the air at one end of the tube. And in this

## What Will Tomorrow Show?

AS IT stands now, Dr. Coolidge's cathode ray tube, described on these pages, is nothing more nor less than a marvelous instrument of scientific research.

But what of tomorrow?

It has been the history of virtually every great development in the realm of pure science that no sooner is it completed than it passes immediately into the field of practical usefulness. That such will be the case with Dr. Coolidge's latest creation, there can be little question.

Here is a mysterious stream of energy that performs miracles never before seen. Scientists observe in wonder. They cannot venture to prophesy. They only know that within the grasp of man has been placed a tool of untold power. And they are confident it will not be wasted.

uncertainly glow the magic was performed.

A clear crystal of calcite, or feldspar, placed in the path of the rays, shone with orange light. Removed, it continued to glow for hours, as if red-hot, yet those who touched it found it stone cold! A tube of colorless acetylene gas, bathed by the rays, instantly changed into a yellowish powder—a new substance entirely unknown to science. It refused to melt even under the terrific heat of 4,000 degrees, and it withstood every attempt to dissolve it with chemicals.

An aluminum disk contained in a tube filled with the same gas became coated with a hard, varnish-like film of brown which the most powerful chemicals could not remove. Castor oil turned into a solid substance. Potassium chloride,

which ordinarily is white, turned purple. A disk of wax, exposed to the rays for an instant, became charged with electricity, much as a fountain pen becomes charged when you rub it with a cloth. The charge remained permanent.

It is seemingly magical force that can thus change the form and appearance of common substances of the earth—what is it? Scientists have been fascinated with cathode rays for nearly half a century. Never before, however, have the rays been available to experimenters in any but small and weak quantities. Their production has been confined largely to the inside of a vacuum tube, for that reason the extent of their power and their useful possibilities have remained, for the most part, an alluring and tantalizing secret.

THE importance of Dr. Coolidge's achievement lies in the fact that he has succeeded, at last, in bringing the rays out into the open air with greater intensity than ever before, and putting them to work. In so doing he has opened new opportunities for understanding and tapping the atom's hidden power that may lead to untold value.

No one, not even Dr. Coolidge himself, can tell today how far the invention may take us, or what new things it may give to the world. All we can say is that he has brought forth a rich stream of energy, with power to perform unheard-of things.

Cathode rays are the same kind of rays



# Worlds to Us

By HYATT E. GIBSON

as the so-called beta rays which constitute one of the three important emanations from the element radium. The difference between them is that whereas beta rays are produced by nature, the cathode rays are produced by man with the aid of high-voltage electric current.

**B**OTH cathode and beta rays consist of minute negative charges of electricity, or electrons, moving with incredible speed. The velocity of the beta rays is approximately that of light, or about 186,000 miles a second, while that of the cathode rays produced by Dr. Coolidge with an electrical charge of 350,000 volts is about 150,000 miles a second.

Radium, you will recall, is constantly disintegrating; that is, the atoms of which it is composed are constantly breaking down. Every atom of matter, according to the accepted theory, is a tiny solar system, infinitely small, made up of a central nucleus and electrons which swing in orbits about the nucleus like planets about a sun. The nucleus is positively charged, while the electrons are negative charges.

In most elements of matter these opposing charges are so arranged and so nicely balanced as to preserve the atom as an intact unit and keep it from flying apart. It is a characteristic of radium atoms, however, that this balance is easily upset by outside influences, such as sunlight. Its electrons are constantly being driven out of their regular course, and they fly off into the air.

These streams of wayward electrons are the beta rays. The disturbance they produce results in a second form of rays, called the gamma rays, which are really light waves of extremely short length and tremendous penetrating power. These gamma rays, because of their powers of penetration, are the ones that give radium its value for the treatment of diseased tissues.

The X-rays, which have proved of such tremendous value to men, correspond to the gamma rays of radium. Cathode rays correspond to the beta rays of radium. X-rays and cathode rays both are produced in vacuum tubes which are very similar in design.

The source of each is a heated tungsten filament much like the filaments of your radio tubes, which is continually releasing electrons. This filament serves as one of two metal electrodes contained within the tube. The rays, in each case, are produced by passing a high-voltage electric current between the filament or negative electrode, and the positive electrode, called the anode.

In the X-ray tube the anode is a tungsten plate or shield. When the electrons are hurled against this shield they are reflected through the glass walls of the tube in the form of the extremely short



The Cathode Ray Apparatus

An electric current of 350,000 volts, sent through the glass tube at the top, shoots electrons into the air at a speed of 150,000 miles a second.

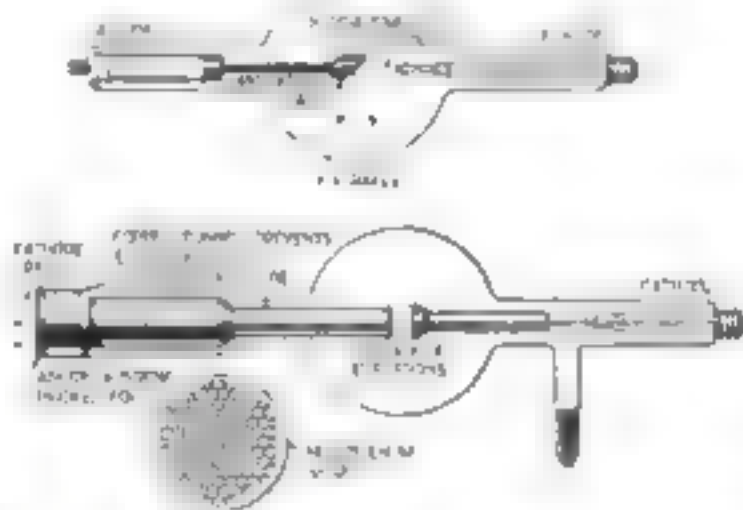
man scientist, P. E. A. Lenard, succeeded in getting small quantities of cathode rays outside the tube through a thin aluminum window. What the Coolidge tube now achieves is to shoot terrific bombardments of electrons out of the tube, like bullets out of a machine gun, and to toss them into space in great quantities and at tremendous velocity.

In fact, Dr. Coolidge estimates that his tube throws off as many electrons each second as would emanate from a ton of radium, which, if it could be obtained, would be worth at least a hundred million dollars! Since there is only about a pound of radium in existence, this means that the tube will produce two thousand times as many electrons as all the available radium in the world!

**T**O PROVIDE an exit for the electron bullets, the Coolidge tube employs a window consisting of a circular film of nickel only five ten-thousandths of an inch thick and three inches in diameter. This window is braced by a grid of molybdenum, a very strong metal, to withstand the air pressure from without.

The manner in which the electron bullets travel through the tube is in itself amazing. From the heated filament the electrons are released at comparatively low speed—about a mile or two a second. But the instant that the high-voltage current—350,000 volts—is applied, they are literally electrified into action. Within the space of an inch, they increase their speed to 150,000 miles a second or more. Maintaining this speed, they shoot across the tube, guided by a copper shield that keeps them from plunging through the glass bulb, and leap through the nickel window.

But how, you may (Continued on page 138)

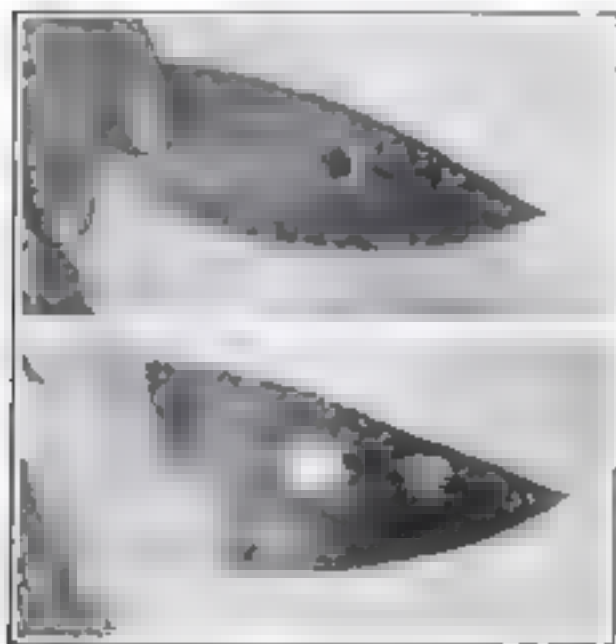


The X-Ray and the Cathode Ray

In the X-ray tube (upper diagram), electrons from a heated cathode filament are hurled against a tungsten plate at the center of the tube. The bombardment is reflected through the glass tube in the form of extremely short light waves, known as X-rays. In the cathode ray tube, the stream of electrons passes, unobstructed, through a copper tube and out into the air through a nickel window

and penetrating light waves. In the new cathode ray tube, on the other hand, the anode is in the form of a "window" at the opposite end of the tube, and through this window the stream of electrons is allowed to pass out into the air at terrific speed.

The cathode rays derive their name from the fact that they are discharged from the cathode, or negative electrode. In the earliest experiments they were produced only in the walls of the tube. About thirty years ago, however, a Ger-



Turned on a rabbit's ear, the cathode rays caused small round scabs (above) which fell off. Two weeks later a thick new growth of snow-white hair (below) replaced the original gray hair.

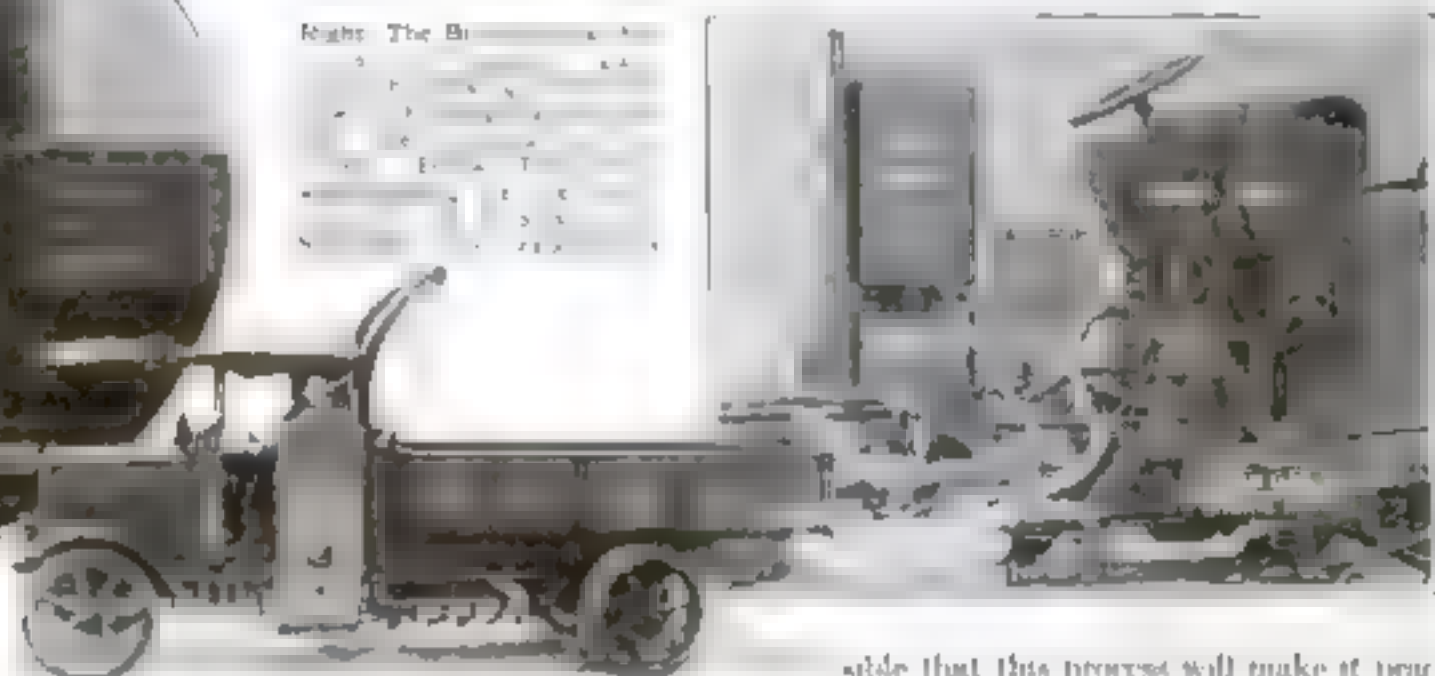


# Water or Dust May Run Our Cars

*Wood, Coal, and Corn Are Other New and Strange Gasoline Substitutes*



The French car burns wood, burning fuel in a furnace in which it generates gas for fuel in place of gasoline.



By JOHN E. LODGE

**A**N AUTOMOBILE that burns wood instead of gasoline, one of the strange type recently designed by the French inventor Dubert, has just been purchased by the U. S. Bureau of Standards in Washington, D. C. This remarkable car, which runs on the coal-gas produced in its own wood or coal-burning furnace, represents one of many attempts that engineers and chemists are making to provide new motor fuels against a predicted future shortage of gasoline.

Already French scientists have produced an electric car that runs more than 300 miles without recharging, but though electric and steam power may remain to fall back on in case of need, many scientists declare that will not be necessary, and that natural or synthetic fuels will make man independent of the gasoline supply. Wood, coal, vegetable oils, ether and even corn, water, molasses, and grain dust are possible sources for substitute automobile fuels.

**SCIENCE**, in attacking the problem, is following three separate lines of research. First, to produce directly an inflammable gas to be mixed with air and exploded in the cylinders. Second, to manufacture a cheap liquid fuel that, like gasoline, can be gasified to form with air an explosive mixture. Third, to use a fine, inflammable, solid dust suspended in air to form an explosive mixture.

Inflammable gas as a fuel for internal combustion engines is not new. Stationary motors have been run on gas. In fact during the war, when gasoline had to be conserved for airplane use, London omnibuses were run on illuminating gas, carried in large rubber bags on the tops of the vehicles. Only lately has it been thought feasible for a moving automobile to carry its own coal-gas generating plant. One of the new wood-burning cars, carrying fourteen persons, not long ago took

its passengers for a 3000 mile tour of France at a fuel cost of \$14.50, against \$120 for the same mileage on gasoline.

Blue water gas, a form of producer gas made by blowing steam over the incandescent bed of a coal fire, also has been tried. Interesting experiments have been made by a British manufacturer with a truck burning coal charcoal, even, or in fact, any material rich in carbon. Chemists tell us that this blue water gas consists of a mixture of hydrogen and the inflammable and poisonous gas, carbon monoxide. Coal gas is mostly hydrogen.

Now another French scientist, Prof. Charles Henry, announces that he has made hydrogen for fuel from water vapor with the aid of a secret catalyst, some of these strange chemicals that make a reaction take place without itself taking part in it or being used up. The temperature he uses is that of the gas range or coal furnace in your home. It is pos-

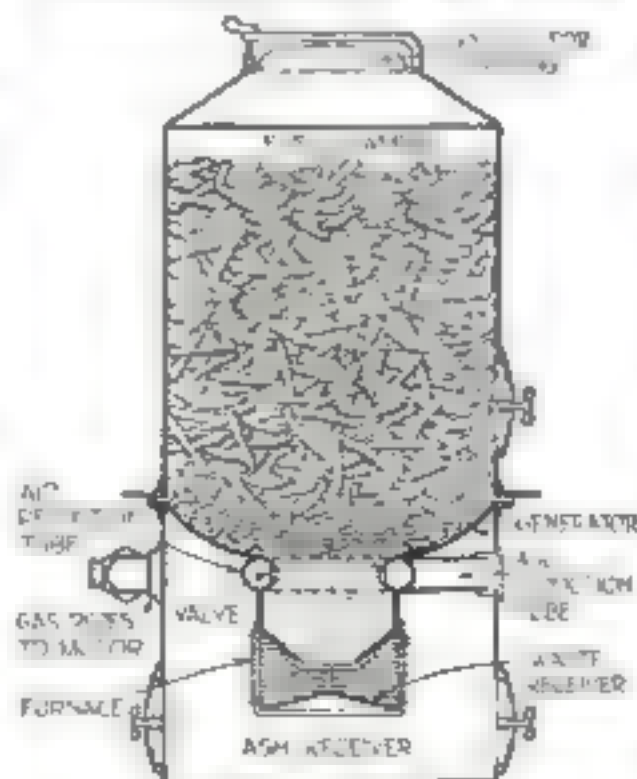
sible that this process will make it practicable for you to stop your car at the filling station of the future and call for "five gallons of water" instead of gas.

But even if all these discoveries should come to naught, scientists have liquid fuels to fall back on. Alcohol-burning engines have been made. White alcohol from wood is at present expensive, other sources may reduce its price. Methanol, a recently developed German fuel substitute, is a wood alcohol produced from coal and water. In France, ethyl alcohol, the potable variety, has been synthesized for fuel. Molasses is another possible source. A Russian, M. Makhorine, reports a fuel from a specially heated vegetable oil.

Use of ether as a motor fuel has been advocated. This compound has the advantage of not carbonizing the cylinders. All of its combustion products are gases, blown away through the exhaust.

Dust has been tried as fuel in a fascinating series of experiments. In the last issue of *POPULAR SCIENCE MONTHLY*, the Department of Agriculture's experimental cornstead motor was described. Grain dust is exploded as fuel in this strange machine. Coal dust has also been employed with some success in Germany, using the Diesel engine.

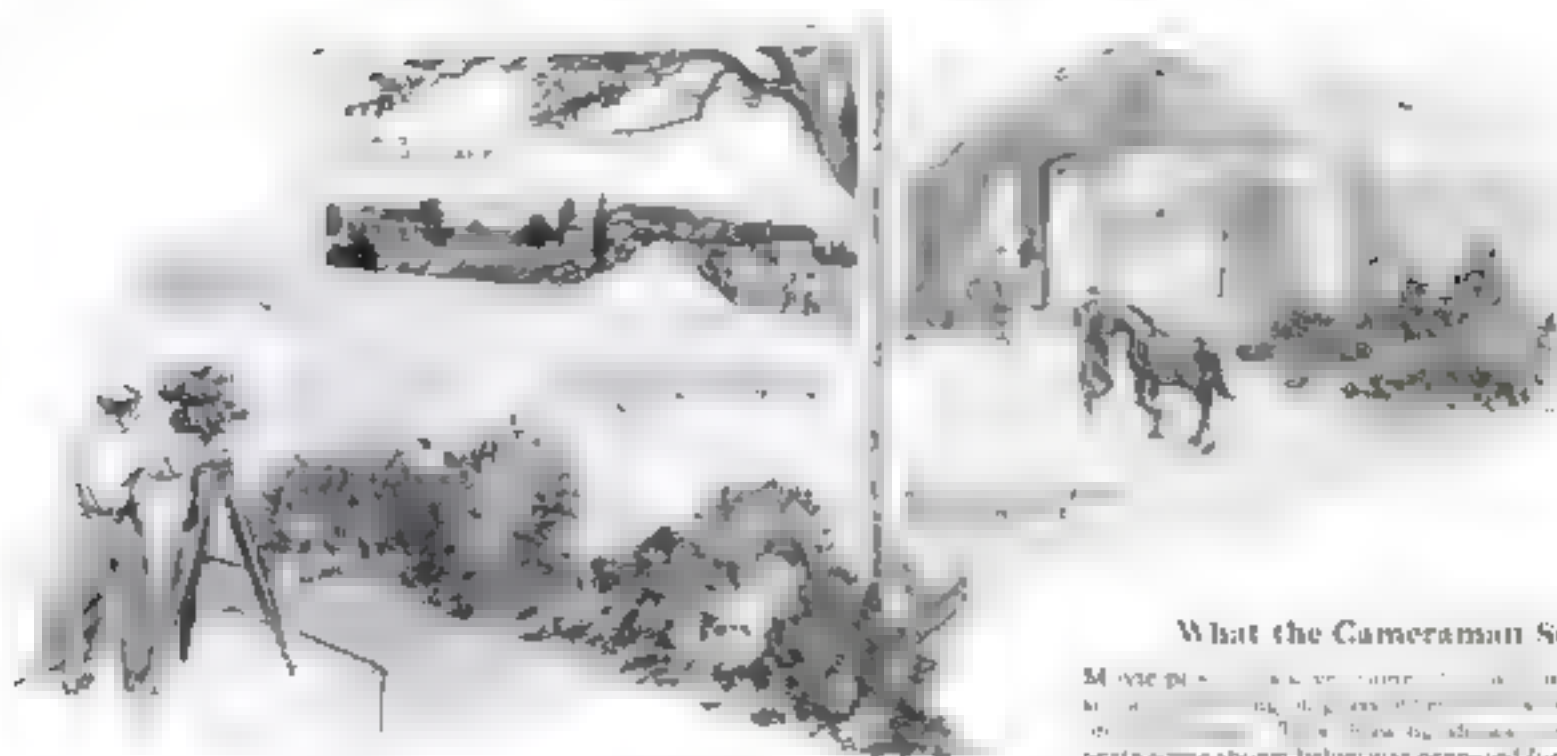
It seems to be only a question of time before one of these many processes will appear on a commercial scale.



This diagram shows how the furnace of the French wood burning truck is designed to generate inflammable gas which, mixed with air, is exploded in the cylinders of the motor.

**GASOLINE**, which is chemically a carbon-hydrogen compound, has been synthesized some time since by Prof. Franz Fischer, director of the Institute of Coal Research in Germany, who combined the hydrogen and carbon of coal-derived water gas under tremendous heat and pressure. Now he announces a startling improvement in which these factors are no longer necessary. A new catalyst obtains the same results. A pleasant smelling gasoline, clear as water and possessing valuable antiknock properties, is obtained. Another German, Dr. Bergius of Heidelberg, has combined compressed hydrogen directly with coal paste to make gasoline.





What the Cameraman Sees

Movie pictures are made by joining a central background, in this case the sky, to be shown in the foreground. The scene below shows the elaborate scene shown below was prepared for the camera.

# How the Movie Camera *LIES*

*Why You Can't Trust Your Eyes While You Watch Spectacular Effects on the Screen*

By SUMNER SMITH

**T**HE camera never lies, they say. And yet—

You see the cowboy hero of a Western movie thriller pursued by a bright band, spur his spirited steed to a canyon's lip. Horse and rider seem certain to plunge a thousand feet to destruction. And then, just when you gasp in horror, the horse gallops his legs together, keeps high in the air and clears the abyss. A fifty-foot jump, you calculate quickly. What a marvelous animal! What courage that actor has!

Or, in a drama, you see the action begin in New York, then move to London, Paris, Cairo perhaps and back again to New York. Twenty players traveling halfway around the world to supply an hour's entertainment! Transportation alone must have cost in the thousands!

Perhaps it is one of those swashbuckling hair-raisers, set in the period when knights were bold, that you are witnessing. Brave men and fair ladies move about in a medieval atmosphere. Huge castles and palaces lend realism to the scene. Once again you are awed by the magnitude of the cash outlay that is required for backgrounds such as these.

However, in the movies, things are not always what they seem. The cowboy may never have set foot within a hundred miles of the canyon he leaped. That "globe-trotting" company of players possibly never left Hollywood or Long Island. Those castles whose size and magnificence gave you a thrill probably could be carried around on the running board of a trolley.

They were just clever paintings on glass.

More and more, as motion pictures develop, producers utilize clever illusions—tricks of photography, lighting and what may be loosely called scene painting—to make the action of photoplays more convincing. No industry—or art, if you prefer—probably has made wider use of the gifts of science or of the inventive powers of ingenious minds.

Take the glass backgrounds, for example. Not so many years ago, no director or continuity writer in an American moving picture company would have dared call for a scene showing the exterior of the British Houses of Parliament. Nobody knew any way to get such a scene other than by the expensive and time-consuming expedient of sending a producing company to London. Now, a

photoplay script may specify a scene in almost any location in the world and it can be made easily without transporting actors and cameramen off their own "lot."

**T**HE process is described in pictures on these pages. A scene representing the lower part of the desired location is constructed in the studio. Then, working from photographs, a clever artist copies the upper part of the building on glass. The glass painting of the upper stories begins at the place where the constructed first story stops, so that, when the time arrives to "shoot" the scene, the two may be matched together without disclosing the line of junction in the completed film.

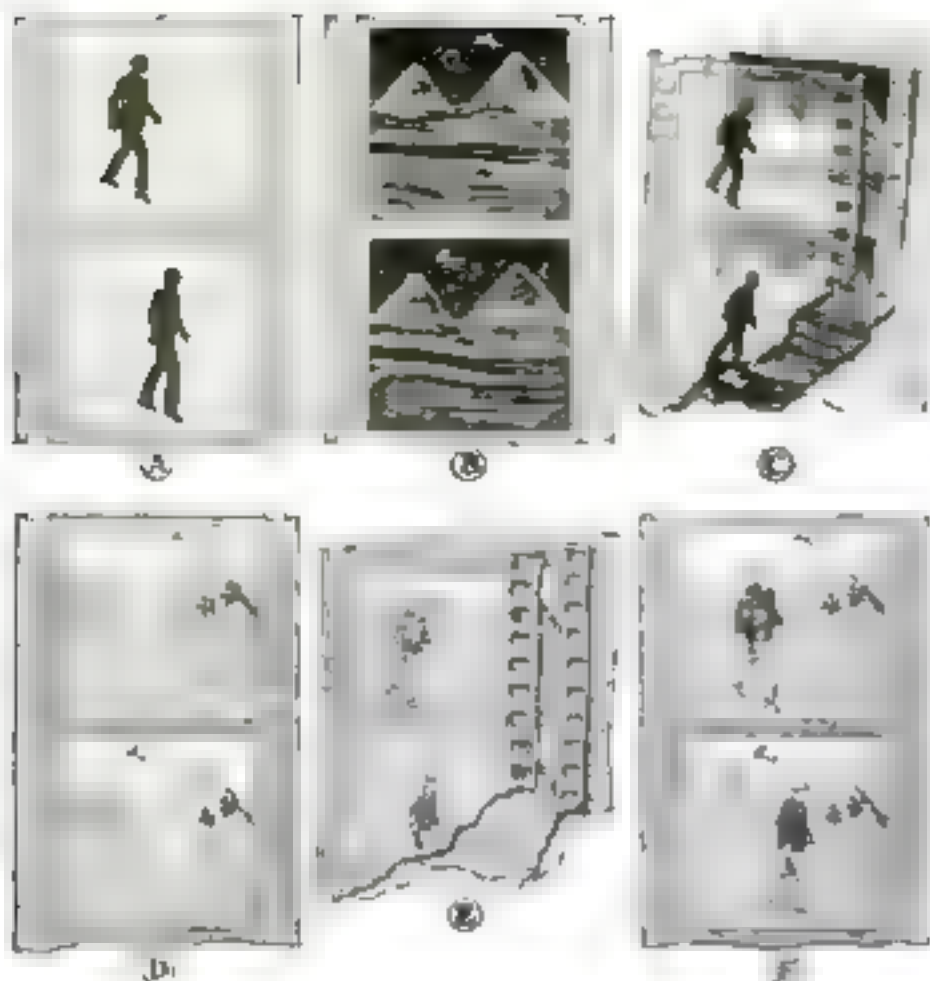
The glass part of this composite scene is smaller than the portion that has been built, but it is smaller in a certain definite proportion, in accordance with careful calculation of perspective, camera focus, and similar details. When the scene is photographed, the glass part is hung in a frame close to the camera. Then, if the calculations are right—and they always are these days—the film will show the composite building as a unit, with the actors performing in the lower part and the upper part stretching convincingly toward the sky.

The huge cathedral shown in the production of "The Hunchback of Notre Dame" was an excellent early example of this method of working with miniature glass backgrounds. In fact, so realistic was this set, that a publicity man, unaware of the details of the trick, wrote an



This is the scene depicted in the drawing above as it appeared in the film as completed for showing to movie theater audiences.





### Movie Globe-Trotting

By means of the ingenious process illustrated at the left a scene photographed in a studio can be placed on a background made anywhere in the world. The drawings show: (A) an intensified positive print of an actor photographed in a studio, (B) a negative of the pyramids, (C) the printing of A and (B) concurrently to produce D, a positive of the pyramids with a transparent figure of the actor, (E) the printing of D and an unintensified positive of (A) to produce the master negative from which the positive (F), to be used in the photoplay shown to the public, is printed.

article telling of the tremendous expense involved in duplicating the cathedral after he saw the first print of the picture.

But why go to the trouble of building a two-section set of the House of Commons, say, if that's wanted in a picture? Can't an actual moving picture of the House of Commons be made, and then the studio action placed on that picture by double exposure? Yes, that can be done, but it's no such simple process as double exposure. In fact, the method by which a scene taken in a studio in Hollywood, for example, can be transferred to an actual motion picture of, say, St. Mark's Square in Venice, is one of the most ingenious processes ever developed for the screen. Frank Williams is responsible for this amazing trick of photography, and he worked on his idea seventeen years before he used it successfully. A pictorial outline of this method illustrates this article.

**ASSUME** that a picture story requires the hero fight a duel in the shadows of the pyramids of Egypt. The duel is fought in the studio and photographed against a black velvet background. Then a motion picture of the pyramids is obtained, either actually made in Egypt or in the studio from a still photograph. The print of the duel scene is intensified with a silver nitrate solution until the duelists are shown as black silhouettes on otherwise transparent film. This film is superimposed on the negative of the actual scene of the pyramids and both are run concurrently through a printing machine. The resultant print is a positive of the pyramids containing transparent figures corresponding to the silhouettes of the duelists which blocked off the light in the process of printing. This positive and an unintensified positive of the original duel scene are then superimposed and run through the printer.

The movements of the actors in the duel scene coincide exactly, of course, with the transparent figures in the pyramids scene and the result is a negative,



### Flames of Steam

The upper picture shows a striking effect in "The Sorrow of Satan"—a shadowy figure of Satan surrounded by flames. The lower drawing illustrates how this effect was produced in the studio with a "curtain of steam."

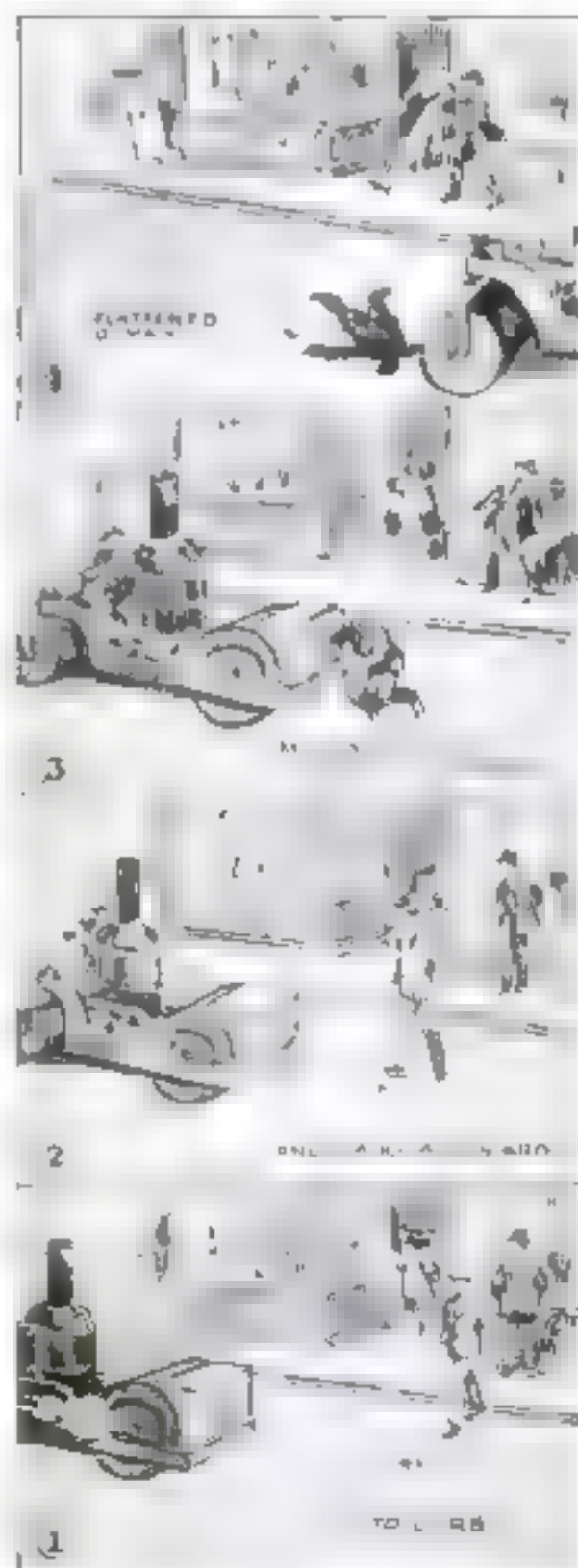
having the pyramids in the background and a duel in the foreground. From this negative the duel scene that is used in the photoplay is printed. By this method the cowboy hero can leap a fifty-foot chasm on his horse without ever leaving the studio, and hero and villain may stage an entirely convincing death struggle on the edge of a cliff without ever going near the cliff.

Few, probably, among the millions who attend the 30,233 American moving picture theatres every week are aware of the extent to which this legitimate and ingenious trickery is practiced. The secrets of their tricks are jealously guarded by film companies. Will Hays, "movie czar," has told producers that widespread understanding of film artificers would cause the pictures to lose in realism. The principal fear, of course, is that daring heroes may lose prestige. Once let it be known that

a "stunt" had been "faked" by a particular actor, and movie audiences thereafter would look with suspicion even upon his most courageous exploits.

One of the most useful devices in the cameraman's bag of tricks is the practice of turning the crank of a camera backward. When the camera action is reversed and the film run through the projector normally, the action that was pictured is reversed on the screen. Thus, if a man walking is photographed with reverse camera motion, when the picture is shown on the screen the man is seen walking backward.

**YOU'VE** seen a film hero rush toward a high wall, leap upward, catch the top and then draw himself up and over the wall? Reverse motion—nine times out of ten! What the actor really did was crawl over the top of the wall from the opposite side, drop to the ground and then run away—backwards. You've seen—especially in comedies—an actor run into the path of a rapidly mov-



How a comedian can be apparently flattened by a steam roller. The action is made in reverse, actor and roller backing while the film is run backward, as shown in the pictures above, from top to bottom. Then, on the screen, the action is shown as indicated by the numerals



ing automobile, get knocked down and run over, and immediately arise and walk away unhurt? Reverse motion again!

As the cameraman began grinding the automobile started backing away and the actor started walking backward toward the sidewalk. When the resulting film was run in correct sequence, the automobile was shown dashing down upon and running into the man who seemed to stroll nonchalantly into its path. In this case, another ingenious but simple camera trick doubtlessly also was employed—slow cranking. To reproduce the effect of a swiftly moving auto, the cameraman turned his crank with leisurely deliberation. When this 'slowly taken' film was later projected at normal speed, the thrilled audience saw action of some duration compressed into a few moments with the resulting illusion that the oncoming car was traveling at high speed.

**WHEN** a steam roller passes over the body of an unfortunate comedian, no one believes that the flattened strip left on the road is the actor. Yet it may be puzzling to see the body rise, assume the normal shape of the comedy hero, and walk away. Here again reverse cranking was employed. At the proper time the camera was stopped, and as the machine was about to run over the luckless comedian, a cloth strip was substituted. Then the same process was reversed. Reverse cranking helped speed up the action and conceal the substitution, passing over the trickery too rapidly to disclose it.

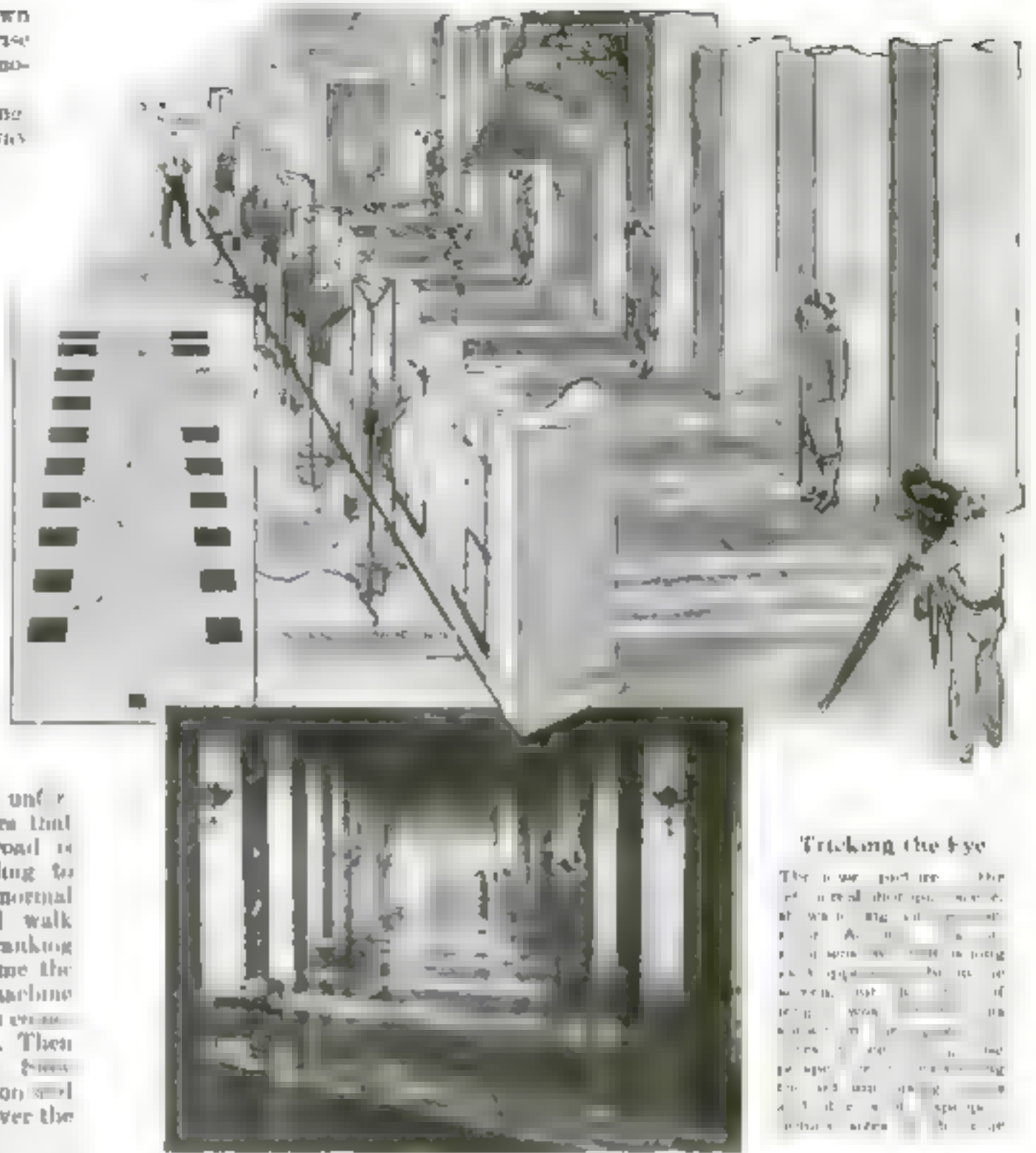
Once, when photographic trickery was new, a tragedy of the films occurred in Great Britain. An English producer saw an American film in which the hero, swinging from the cowcatcher of a speeding express train, pulled from the tracks to safety the limp body of the heroine. The Englishman didn't know that the scene was faked, that the engine backed away after the hero had dropped the lady on the ties while the camera ground backward. And when his cast attempted to duplicate the feat, from a real express train, the actress was killed.

Dashing bravely through the roaring flames, the hero risks almost certain death to rescue the child at the head of the fire-swept stairway—a feat accomplished without even singing his wavy hair! Stage flames from burning clouds of lycopodium powder, fully spectacular but not even very hot, were blown across the set between the actor and the camera. So it was that many of the effects in recent war pictures were

obtained. Here by the way is an interesting illusion. The camera has only one eye—and it takes two to judge distance. If you shut one eye and watch them taking that picture, you would swear the man was in the midst of the flames. And so it appears on the screen.

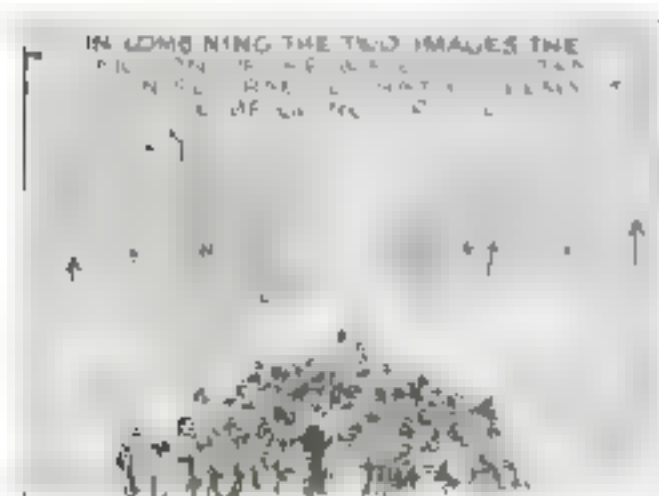
**THROUGH** the camera's single eye, a study model of a scene at close quarters looks the same as the real thing some distance away. Albert E. Smith of the old Vitagraph Company, during the Spanish-American War, used a variation of this stunt to put over what is probably the first bit of movie trickery on record. The battleship *Main* had just been sunk, and vivid headlines in every newspaper carried fresh messages of conflict and turmoil. People demanded pictures of the battle scenes, pictures there was no way of getting. So in his Brooklyn back yard Smith set up a tank and filled it with water. His men whittled miniature blocks of wood to resemble battleships, and Smith pasted newspaper photographs of the ships to their sides.

Smith with red-hot wire set off tiny charges of powder behind the miniature battleships. What the camera, steadily grinding a few (continued on page 17)



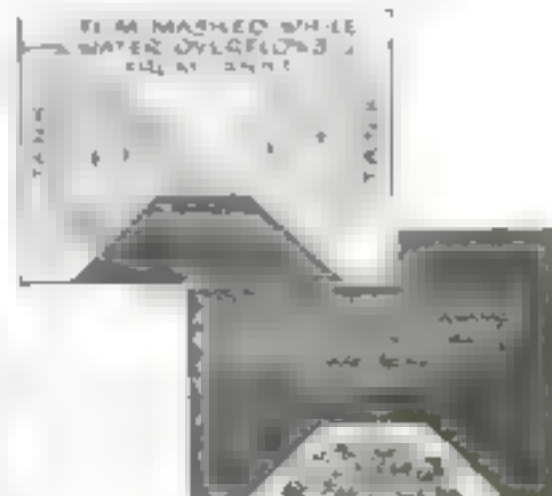
Tracking the Eye

The camera has only one eye—and it takes two to judge distance. If you shut one eye and watch them taking that picture, you would swear the man was in the midst of the flames. And so it appears on the screen.



All Done on Dry Land

In "The Ten Commandments" the Red Sea parted to permit the passage of the Children of Israel and then closed upon the pursuing army of Pharaoh. This amazing effect was produced by double exposure and reverse motion as shown above, the waters being photographed in a small trough





# Do Our Athletes

*It's a Toss-Up Between the Better--How Do You*

By ARTHUR  
GRAHAM

## They All Turn Out

In the olden days only the star athletes engaged in college sports contests. Today virtually all students take part in competitive athletics of some kind as part of the curriculum. Here is a typical gymnasium scene at Columbia University.

**W**HY, when I was in college—“No need to go further. You know the words and music of the song that the old grad loves to sing. Its burden is ever the same—that in these soft and effeminate days we don't grow the sort of men who used to wear the dear old Black and Blue. Your dad sings it to you, his dad sang it to him, and you'll sing it to your son when he has the impudence to try to tell you that D. F. Brown, 1842, is the niftiest and shiftest back who ever twisted a pair of snaky hips out of reach of the itching fingers of a would-be tackler. “Why,” you'll say scornfully, “back in '80 we had a fellow named—”

Oh, well, what's the use? There are few really new things in this old world, and most of those few are neither ideas nor arguments. But facts always are valuable and sometimes are interesting. I decided that I would try to get the facts in this case; that I would try to learn whether the athletes—especially the college athletes—of a quarter of a century ago really were better than are the athletes of today.

**I**N QUEST of this information I called on Dr. William Gilbert Anderson, director of the Yale University gymnasium. Dr. Anderson has devoted his life to physical education. He has traveled, and studied mankind, in many parts of the world, and holds degrees from several universities. For more than thirty years he has been a member of the Yale faculty, and for most of that time has been director of the gymnasium. During his career he has seen many college generations come and go. Few men have had equal professional training, and as few have had equal opportunity for studying the college student, both the athlete and the nonathlete, at close range.

I found Dr. Anderson in his pleasant office in the gymnasium building. He is a man who has practiced what he has preached and still preaches—sensible living; a tall, erect, white-haired, dignified gentleman who isn't afraid to smile. He smiled when I asked him my question about athletes.

“A really great athlete,” he said, “is an

exceptional man. There were great athletes at Yale twenty-five years ago, there are great athletes at Yale today, and there is no reason for thinking that there will not be great athletes at Yale twenty-five years from now.

**T**WENTY FIVE years ago—that would be 1892. Two of the greatest football players who ever lived played for Yale in 1892—Tom Storlin and Jim Hogan. But there have been great Yale football players since their time—Bumpster, Kilpatrick and Ted Coy, among others. And there have been other fine Yale athletes. There was Al Sharpe, who won his letter in football, baseball, track and basketball. There was A. C. Gilbert, who held the pole-vault record, was the champion gymnast of the university, an expert boxer and wrestler, and the most skilled straight-of-hand man that I've ever watched. And there have been many others. The only difference that I've noticed between the athletic star of twenty-five years ago and the athletic star of more recent years is that the outstanding athlete of today seems to be more

versatile. But that probably is accounted for by the fact that now there are more sports in which an athlete may participate, rather than by any change in the men themselves. The great athlete of today has exactly the same qualities as had the great athlete of any other period. He is an exceptional man, and you can't draw any very illuminating general conclusions from

the study of exceptional men in any line.

“But it is possible to draw valuable conclusions from the careful observation of large numbers of men. A careful study of the college freshman of today shows that he is a better man physically than was his father when he entered college. The change, of course, has been small, but it has been in the right direction. I think that this improvement has been brought about by supervised athletics and physical training in the preparatory schools.

**E**ACH Yale freshman, shortly after he enters college, receives a thorough physical examination. The data obtained from these examinations has been tabulated and studied, and it proves these things about the average freshman of today, as compared with the average freshman of twenty-five years ago:

“The freshman of the present is taller. He has gained, according to the figures, a full inch in height. This increase in height perhaps is more apparent than real, for very possibly it is a result of better



Could They Win on the Gridiron Now?

The Chicago University football team of 1892. These players were men in appearance as well as in fact. Is the smooth-faced college football player of today superior to his bearded and muscled predecessor? A careful study of the two has shown interesting and surprising results.



# Equal Stars of Old?

## Great Ones, But the Average Today Is Compare with Modern College Men?

posture. The average young man of today stands up straighter than did the average young man of twenty-five years ago. That is an improvement much more important than an actual increase in height.

"The freshman of the present has a better chest. He has gained an inch in chest measurement. This also, I think, is partly the result of better posture. The man who stands straight breathes deeper than the man who stoops, and deep breathing increases chest capacity.

"The fresh man of the present is a few months younger, and about a pound lighter.

"**I**N PASSING, I might say that the average young man who enters Yale is, according to the latest available figures, a few months under nineteen years old. His height is 5 feet 9 9/16 inches, his chest measures 36 7/16 inches; and he weighs 144.2 pounds.

"While this improvement is encouraging," continued Dr. Anderson, "it does not mean that most of the young men who come to Yale are free from physical defects. In a recent freshman class 310 men were round-shouldered, 162 were flat-chested, 283 had kyphosis, or stooped shoulders, and most of them had lateral curvature of the spine. Nearly a hundred of them had flat feet, or were threatened with fallen arches. In many cases these conditions can be remedied by proper exercise. This body-building work is carried on under the direction of my brother, H. S. Anderson, and Robert Kipluth. Gymnasium work is compulsory for the freshman, unless he shows special interest in and aptitude for some sport and has no serious defects to be corrected by special exercise. To be graduated from Yale, a man must be able to swim, and swimming is one of the most popular of the indoor sports. Boxing, basketball, wrestling, squash and fencing also are popular. If you will come with me, I will show you something interesting."

**H**E LED the way down a corridor to an open door. In a large, well-ventilated room forty or fifty young men, stripped to the waist

and sweating freely, were cheerfully going through a series of calisthenics whose severity would have brought growls of protest even from well-disciplined soldiers.

"That," said Dr. Anderson, "is Bob Kipluth's swimming squad going through some of its preliminary training. As you know, he is one of the most successful of the college swimming coaches. Almost every young man who comes to college wants to 'make a team.' We use that perfectly natural desire to help make our body-building work interesting. If those same boys had been ordered to go through that same work just because they needed it, they would have done a lot of dithering and put a little cussing over it. But so long as it is a part of the training for a recognized sport they undergo it willingly. No matter what sport a freshman takes up, we see that he gets some of the body-building work that he needs.

"**P**ERHAPS you noticed," he went on, "when we were back in his office, 'that although those young men were going through the same exercise, they were not working in unison. We have found by experience that allowing each man to use his own sense of timing gives more satisfactory results than asking for the sort of precision that is demanded of soldiers at drill. In the last twenty years gymnasiums have changed far more than have the men who use them. Dumb-bells and Indian clubs have become relics of the past. You will find but little apparatus in the modern gymnasium. We have learned from the Germans and the Swedes that free calisthenics are better developers than work on the horses and the parallel bars.

Personally, I would be well content if we could teach every man who comes to the Yale gymnasium to

### Marvel of His Day

Fifteen years ago, Ted Coy, Yale football star, was hailed as a marvelous all-round athlete. The great athletes of today says Dr. Anderson, have the same exceptional qualities as the famous stars of the past.



A Famous Runner of the '80s

Lon Myers, in the '80s the world's most versatile performer on the track. At one time he held world's records for events ranging from sprints to long distances. Since then all his records have been eclipsed. Would Myers have a chance with star track men of today?

do two things—to keep the back of his neck against his collar, and to relax now and then.

"Correct posture is a necessity for good health. It gives the organs of the body a chance to do their work properly. It is largely a matter of habit, and it is not insisted upon as strongly as it should be in most of our preparatory schools. It can be practiced at any time and in any place—while you are walking on the street, while you are sitting at your desk, while you are dressing, while you are driving your automobile. Just lift your head, draw in your chin until the back of your neck presses against your collar, arch your chest to its utmost, and draw in the abdominal muscles. Do that twenty times a day, holding the position for five seconds each time, and in a few weeks you will find that your posture is greatly improved. You will look better, and—more important—you will feel better. It will take less than two minutes of your time a day to form the good habit of standing correctly, and it will exercise most of the important muscles of your body. I give that advice to every freshman who needs it, but I'm sorry to say that not all of them follow it.

"**T**EACHING college boys to relax is an almost hopeless task. Most of them aren't organized that way. Yet every day I see business and professional men 'being up' and in that way squandering energy that they need. If in their college days they had been taught to relax for a few minutes every hour or so they would last. (Continued on page 111)





# MARVELS We May See in 1927

## Leaders in Many Fields of Science Forecast an Amazing Future for Us

### Medicine and Surgery

WILLIAM J. MAYO, M. D., Sc. D., LL. D.  
*Surgeon, Mayo Clinic, Rochester, Minn.*



**T**HE invention of the microscope made possible the epochal work of Pasteur which brought about the popular recognition of the role of microorganisms in the causation of disease. As a result, the scourges of contagious and infectious diseases have nearly

disappeared in civilized countries.

Today vision is being extended into the ultramicroscopic field which concerns those biochemical changes which bring about the degenerative diseases of middle and later life. The increasing proportion of deaths from cancer and diseases of the heart, kidneys, and other vital organs affords hope for the future rather than discouragement, because these are the afflictions of middle and old age and prove the advance of the medical frontier. In the older day, the greater number of human beings died before the period of life at which these diseases develop. Our newer knowledge of the cellular and molecular changes in the tissues and fluids of the human body is vitally influencing the practice of internal medicine through methods which lead to immunization and reconstruction.

As for surgery, rehabilitation by physiochemical means, by which the patient is restored to as nearly normal condition as possible before surgical operation, is enabling surgery to obtain astonishing results.

### Ocean Transportation

REAR ADMIRAL BRADLEY A. FISK, U. S. N.  
*Marine Engineer, Engineer*



**O**NE of the most important advances in ocean transportation in 1927 will be the increased use of the Diesel engine in both direct acting and geared forms and also for driving small electric gener-

ators that feed motors on the propeller shafts. The Diesel engine has come to be such a menace to the steam engine that boiler and engine makers are prosecuting elaborate researches to enable the steam engine to meet the competition; mainly by making higher pressures practicable and by the use of pulverized coal. At the moment, the latter seems to be the more promising method of combating the

competition, at least for the Merchant Service.

The use of radio and of scientific apparatus and methods will increase, especially for direction finding, hearing submarine bells, ascertaining the depth of water and the like.

The advance which will be the most significant as to future events will be the increasing importance on the sea of Germany, Italy and Spain. The magnificent combination of inventiveness, constructiveness, foresight, industry and courage which the German people possess, has already almost put Germany back where she was before the war.

Meanwhile, the United States will continue to fall behind with rapidly increasing speed. In a few years, she cannot fail to be at the rear of the maritime nations. Then those nations will feel a temptation (perhaps beyond human resistance) to blockade her trade routes and seize her wealth.

### Zoology

W. T. HORNADAY, Sc. D.

*Zoologist, Former Director, N. Y. Zoological Park*



**I** PREDICT that at its next session the Sixty-Ninth Congress will pass a new bill to provide federal sanctuaries for migratory birds, and the Copeland-Merritt bill to reduce the bag limits in twenty-three states on migratory game.

I predict that next year a good number of state legislatures will enact new laws to safeguard the surviving remnants of their vanishing wild life.

I predict that the great awakening now taking place throughout the United States on the subject of the extermination of wild life will culminate in 1927 in a nation-wide demand for drastic reforms in our present fearfully weak, inefficient and deadly system of wild life protection.

I predict that in the fall of 1927 the voters of Cleveland, Ohio, will vote a special tax law, of one tenth of a mill for five years, to meet the cost of important new zoological developments in that city. This would give Cleveland a thoroughly modern and up-to-date zoological park already designed to cost \$1,500,000, and it will be followed in due course by an aquarium and a botanical garden.

Finally, I predict that in 1927 the efforts now being made in the New York Zoological Park to breed the vanishing musk-ox of Arctic America in captivity will be successful, and that the capture of musk-ox calves on the east coast of Greenland will be prohibited for five years.

### Polar Exploration

VILHJALMUR STEFANSSON  
*Arctic Explorer*



**I**N EVERY respect but one, the sensational Arctic flights of 1926 merely advertised to the public the tried knowledge and accepted deductions of the scientists. The one exception was when Wilkins reported the definite existence of land in a previously unexplored area of ten thousand

square miles north of Alaska, and when Amundsen reported the same thing a few weeks later for a previously unknown strip also on the Alaska side of the Pole. These results were expected by about half the scientists and unexpected by the other half.

Two things that were much debated, and which therefore came near the field of actual discovery, were settled by Byrd and Wilkins. These two flyers showed not only that the winter Arctic climate is peculiarly favorable for flying, as compared with average temperate or tropical climates, but also that air bumps, air holes, and roughness of the air generally, while appearing in spring and (doubtless) through the summer, are absent in the Arctic in winter.

The Argentinians are to fly in the Antarctic the coming year; Wilkins, Nobile, and others have announced they will fly in the North. Others, such as Byrd, may fly there also. What we may expect is that these flights, if made, will further confirm scientific opinions.

It seems certain that no new land can be discovered in the Antarctic. There is a fifty-fifty chance that islands will be discovered in the Arctic.

### Geology and Mining

THEODORE J. HOOVER

*Professor of Mining and Metallurgy, Leland Stanford University*



**R**ECOGNITION by the public that we are spending our mineral resources "like a drunken sailor," and that their exhaustion is within measurable distance, would be the most important

thing that could happen in geology and mining in 1927.

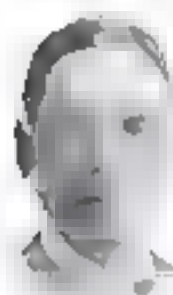
Any advance in this direction, and there will be some advance, though small, will be the most important advance in this field for 1927 or any other year.



## Bacteriology

EDWIN O. JORDAN, Ph.D., Sc.D.

Professor of Bacteriology, University of Chicago



IT SEEMS probable that we are on the verge of important discoveries in the bacteriology of measles, and that a specific microbe will soon be firmly established as the causal agent of this infection. In tuberculous, results of the vaccination of children by Calmette's method are

highly impressive; every year adds to their significance.

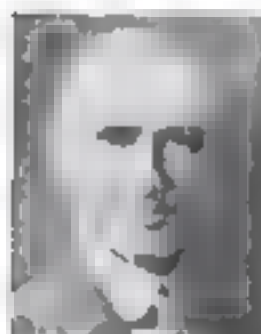
In 1927 we are likely to learn important facts regarding the nature of virulence and its correlated characters, the nature of bacterial toxins, the causes and meaning of bacterial variation, the specific soluble substances of bacteria and the nature of bacteriophage. We may expect to have light cast on several obscure immunological phenomena.

We shall probably know something more by the end of another year about scarlet fever, poliomyelitis (infantile paralysis) and possibly epidemic encephalitis. The identity of the African disease resembling yellow fever is likely to be established. At any time important discoveries may be made in the field of filterable viruses, and in such baffling infections as chicken pox, canine distemper and the mosaic disease of tobacco.

## Mechanical Engineering

DEXTER S. KINDALL, M.E.

Dean, College of Engineering, Cornell University



ONE of the outstanding features of modern mechanical engineering is the growth in size of industrial machinery. The first locomotive weighed about four tons, while some modern locomotives weigh more than 300

tons. The first electrical generators were mere toys; we are now building turbo-generators that can produce 50,000 kilowatts from a single unit. It is not likely that we have reached the limits of construction in any field demanding large apparatus, and it is interesting to speculate what the maximum size of such machinery may be.

We shall probably see a considerable development in Diesel engines and other

internal combustion engines using oil and other liquid fuels. This development will probably be in the direction of increased size of units. Already this form of prime mover has made a place for itself in marine work, and efforts to apply it to locomotives, automobiles and even flying machines have a fair chance of being successful.

We shall see, also, a continued extension of the methods of quantity production. Our successes in producing clothes, shoes, sewing machines, automobiles and many other products at prices unattainable by older methods make it certain that we shall extend these methods to other lines.

## Radio

ALEXANDER SENAUKE, M.E., E.E.

Radio Engineer, Popular Science Institute of Standards



THE year 1927 will see a great awakening on the part of the general public to the value of faithful and accurate tone reproduction in radio reception. Tremendous strides along this line have been made by

the manufacturers of radio receivers and loudspeakers, and broadcast listeners will be educated up to a new standard of quality.

The novelty of receiving distant stations is wearing away, but modern receivers are being made more and more sensitive and selective so that the vast listening public located away from the big cities will be able to choose exactly the program desired.

A new radio law probably will be enacted that will iron out the difficulties with interference now causing trouble in some sections, and there is a strong possibility that licenses to broadcast will be restricted to stations able to broadcast worth-while features.

Programs will continue to show steady improvement in quality and variety and a system may be worked out between stations in the same locality so that several stations will not broadcast the same type of feature at the same time. By this arrangement the listener who is partial to some particular form of radio entertainment will be able to tune in the type of broadcasting that pleases him at any hour of the day and will not have to miss one of two features because both are on at the same time.

## Chemistry

EDWIN E. SLOSSON, Ph.D.

Chemist, Author, Director of Science Service



THE hormones, which determine whether we shall be tall or short, handsome or homely, brilliant or dull, cross or congenial, will soon be made in the laboratory instead of exclusively by the old-fashioned and unreliable

action of our glands. And since the chemist is never satisfied with merely imitating nature's products, he is likely to devise something more effective in this field, as he has in dyes and drugs.

In fact, we seem to be entering a new epoch of organic synthesis. Artificial petroleum is now made from coal and hydrogen. Petroleum can be converted into all manner of physiological compounds, including alcohols and fats. Methanol is made from water gas. No man is being freed from his exclusive dependence upon plants and animals for his food and medicine, and may ultimately be able to make what he wants from air, water and coal, in all cases where the factory can compete profitably with nature.

We may predict that in 1927 one or more of the elusive vitamins will be run down and identified, possibly synthesized. It is already known that cholesterol, which has been regarded hitherto as stuffing up the cell to no purpose, can be converted into a vitamin by the action of ultra-violet rays, and so serve as a cure for rickets. In like manner means of activating other inert substances may soon be found.

## Electricity

ARTHUR WILLIAMS

Vice President, New York Edison Company



THERE will be growing appreciation of the value of electric power as an agency for improving the social and economic life of the country; this will be true not alone in the home and in our industrial life, but in

that of the American farmer, a field which is as yet substantially untouched. There

## A Year of Thrilling Revelations Ahead of Us!

IF SOMEONE should ask you today what great new discoveries and inventions you would like to see, you might be at a loss for an answer.

Within our lifetime new knowledge and new utilities for our comfort, happiness, and well-being have come upon us, and it sometimes seems as if nothing more remains to be supplied.

Has science, in its progress, reached the top peak of achievement? Or is it progressing toward rev-

elations that will still further change our lives?

Recently we put these questions to twenty scientists. Their answers appear on these pages. They leave little doubt that we are merely on the threshold in invention, physics, astronomy, biology, psychology, and all the rest of the sciences. They assure us that the achievements of the past few decades, marvelous as they seem to us, are indeed small compared with what the future holds.



# Marvels We May See in 1927

will doubtless be an increasing understanding of the real meaning and value in service of the term "superpower"; a wider realization of the fact that superpower does not relate to politics, but to economics; that it is an agency already long in existence, through which, by means of interconnection, widely separated but large and economical sources of power generation can be united, with as a result more efficient utilization of the power source and greater security of the service to the individual consumer.

## Physics

ROBERT ANDREWS MILLIKAN, Ph.D.,  
Sc.D., LL.D.

*Physicist, Nobel Prize Winner, Head of the California Institute of Technology*

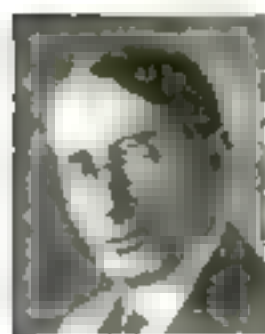


**WE ARE** clearly approaching a reconstruction of the formulation of a considerable part of that branch of the new physics which is included under the general designation, quantum theory.

The simplifications and generalizations which have been introduced this year into spectroscopy by Harold Lande Pauli and Russell the new theoretical formulation of Schrodinger with its application to the Stark effect by Epstein, and the new mechanics developed by Heisenberg, Born, and Jordan; all are indicative of the heroic efforts just now being made to eliminate some of the contradictions in modern physics, and to place the whole structure upon a new basis of experimentally observed facts.

## Psychology

ALBERT EDWARD WIGGAM  
*Biologist, Writer and Lecturer*



**THE** main drive of psychological inquiry in 1927 will be testing the mental tests, devising tests for character and personality and moral and vocational traits and determining better the nature of intellect itself.

Some important researches are under way in this latter field. Very important researches will be pursued in April on the problem of heredity and environment.

New efforts will be made to measure the special aptitudes of high school and college students and to devise emotional incentives that will lead students to measure up to their highest capacities. Two big projects are under way in this direction. A number of colleges are planning a regular psychological consultation service for aiding students in their problems, both vocational and personal. Clinical psychology is rapidly advancing in the devising of methods for removing fear and relieving the depressed mind.

## Astronomy

CAPTAIN EDWIN T. POLLOCK, U.S.N.  
*Superintendent, U. S. Naval Observatory, Washington, D.C.*



**TWO** important projects are now under way at the U. S. Naval Observatory, Washington, D. C., as well as at other observatories, and while 1927 will not see their finish it will see a good beginning.

One is the observation of positions of certain stars to be used in the "Eros Campaign" of 1930-31, when the planet Eros will be used in a newer determination of the solar parallax, or difference in the apparent position of the sun and its true place. Eros, which at times is nearer to the Earth than any other heavenly body except the Moon, will be only 16,000,000 miles away from us in 1930. Mars, at its nearest approach in 1924, was 33,000,000 miles away.

The other project is the "round-the-world" longitude determinations, for which special time signals have been sent these last two months by the United States naval radio stations and for which at the same time astronomical observations were made all around the world. The calculations may be completed during 1927.

These findings will be a start toward proving or disproving the theory that the continents do move and that our moon came from the Pacific Ocean. If it is found that the continents move or that parts of the earth expand or shrink, it may show as some believe, that it is the Earth and not the Moon which is erratic in its motion. But the most important advance that could be made in astronomy in 1927 would be to have some one donate the millions needed to construct a telescope larger than any now in use.

## Automobile Engineering

EDWARD V. RICKENBACKER  
*Automobile Engineer, Author*



**OUR** ever-increasing highway congestion, in the writer's opinion, demands the following development in motor car engineering.

Smaller, higher-speed and lighter engines, resulting in greater economy, shorter wheel base

and lighter complete cars at less cost.

Lower center of gravity, brought about through double drop frame, worm gear drive or a design giving similar results.

Smaller diameter tires with greater cross section eliminating the necessity of wheels and using brake drums as substitute. Tires would be mounted directly on the brake drum, permitting brake application on all four wheels directly over the center of the tire.

Rubber spring shackles as a substitute

for bolts, eliminating squeaks and the necessity of lubrication.

Simplification of starting problem in cold weather by electrical vaporizers or some equally effective substitute.

Increased compression ratios and the elimination of carbon through the use of antiknock fuels.

I believe motor car engines of the better class will be equipped eventually with superchargers for the purpose of reducing weight and to increase the horsepower per inch of displacement. This will be followed by the supercharged two-cycle design for the same purpose.

## Anthropology

CLARK WISLER, Ph.D.

*Curator of Anthropology, American Museum of Natural History, New York City*



**BECAUSE** of the large number of explorers in the field, there is reason to expect new finds of fossil man in Europe, western Asia, or in Africa, the regions so far furnishing us with specimens. Also in North and South America we

may expect new finds suggesting the association of a original man with the mastodon and other extinct animals.

In Mexico and Central America, ruined prehistoric cities may be discovered and more dated Mayan monuments found in them, thus adding to our knowledge of aboriginal America.

The crossing over of the American Indian from Asia to Alaska is a subject now to the fore, and a full half dozen scientists are rummaging the shores of Bering Sea for traces of the earliest crossing from Siberia. We may expect, therefore, new evidence of Asiatic visitors to Alaska long before the days of Columbus.

About the only remaining spot on earth where white men have not roamed is the interior of New Guinea, where still live a few tribes of men not seen by the paleface. This area is now about to be explored, and we may look forward to the last round-up of primitive man.

## Agriculture

WILLIAM CROCKER, Ph.D.

*Belmont Director, George Thompson Institute for Plant Breeding, London, N. I.*



**THE** stage is set for rather large advances in plant sciences in all the branches mentioned below.

We can expect improved varieties of some of our food plants - varieties which give greater yields, greater resistance to disease and insects, and higher quality. Further advances in hybridization or crossing will teach breeders (Continued on page 140.)



# "Now HOW Did You Get That Cold?"

*Probably from the Man Who Sneezed in the Street Car, Answers the Doctor—What to Do for a Speedy Cure*

By FREDERIC DAMRAU, M.D.

**I**F I were to list all the times in my life that a stuffy nose and watering eyes have interfered with my business and social affairs, spoiled my pleasures, ruined plans and temporarily blunted my ordinarily good judgment in professional matters—I'd have to conclude that the net result would place the common cold at the top of the list of all the serious illnesses I've ever had.

Most men, if they think back a moment, will find that this holds true in their cases too.

Public and doctors have long regarded the stuffy nose as a trivial complaint, a necessary but not very important evil. Colds come, —but they have a way of going, too—usually as mysteriously as they came. As a result little effort has been made to study their causes and prevention, and the common cold still is one of the stepchildren of medicine.

As a matter of fact, a cold may be far from a trifling inconvenience, even from a medical standpoint. It may pave the way to some devastating infection, such as pneumonia. You may start out with a cold but end with an ear abscess or even a mastoid infection. It may develop into an even more serious affliction. In short, a cold may indirectly cause death.

It puts more people on the sick list than

## An Expensive Ailment

**C**OLDS cost each of us an average loss of ten days' activity annually, so what Doctor Damrau says on these pages about their prevention has a dollars-and-cents value.

"The germs that cause colds," he points out, "can be projected twenty feet in ordinary conversation. These germs can transmit the ailment only during the first twenty-four hours of the illness. If everybody with a cold, therefore, would stay home at least the first day, the spread of the disease would be materially reduced."

any other illness. Nine out of ten of us have at least one every six months. The average man manages to "catch" three to four of them a year.

The Metropolitan Life Insurance Company kept statistics over a period of one year to find out just how many colds were caught among 6,770 of its clerical employees. There were 2,824 cases so severe as to keep the persons from working, and the average number of days lost in each case was 2.1. But these figures do not take into account the much larger number of sufferers with colds who nevertheless come to work and struggle through their duties as best they can.

**B**ECAUSE it keeps so many persons out of work a certain number of days each year and because hardly anyone escapes it entirely, the common cold probably causes more loss in dollars and cents than any other disease. For these reasons, if for no other, it is demanding the attention of physicians as never before. They are learning its causes and are discovering ways to prevent and treat it.

Where in the world did I catch that cold?—probably is the first question you think of when you begin to feel the stuffiness that you know will be followed by several days of nasal misery. Then you recall how you sat next to an open window, or went out into the slush without your rubbers. "That's where I caught it," you say to yourself.

But have you ever stopped to consider how often you are exposed to drafts or get your feet soaked without the sign of a



cold? Most of us meet with these hazards very often, yet we suffer from a cold only occasionally during the year. A few weeks ago I went to a football game with four friends. When the game was half over we were caught in a cold drizzle of rain. Although our clothes were drenched and our feet soaked from standing in the mud, we remained until the final whistle. One of us caught a cold and, of course, blamed the drenching. But what about the other four?

It is true that colds are most common during the winter months. From observation of more than 13,000 persons, the United States Public Health Service tells us that colds are most frequent in October. The second wave strikes the country around the Christmas holidays, after which there is a gradual decrease in the number of cases until summer.

**T**HIS would appear to point to cold weather as a factor in the onset of colds. But bear this important point in mind: Colds break out all over the country at the same time, from shivering Boston to perspiring New Orleans, and from the sleety streets of New York to the warm sunlit avenues of California. The average fellow naturally blames the weather for his cold; but do the facts justify him?

Dr. D. F. Snaley, of Illinois, made a statistical study among 2,485 Cornell students to test some of the popular beliefs about the causes of colds. He found that students who protected themselves from drafts caught as many colds as those who slept by an open window. Those who were careful to wear rubbers or galoshes during wet wintry weather did not escape any more than did their more stoical fellows. The much vaunted cold bath in the morning proved only of slight value in preventing colds. Among the students who wore woolen underwear, colds were nineteen percent more common than among those who wore light underclothing.

The truth of the matter is that drafts,



The mother who bundles her sniffling child up but lets him pass his whistle, germs and all, to his brother is on the wrong track, doctors say. The whistle is a fine germ carrier.



wet feet, failure to wear woolen underwear, and a host of other superstitions taught by our grandmothers have been greatly exaggerated as causes of colds. Meanwhile few of us realize the really important causes, which physicians have established by careful observations and laboratory experiments, and which must be understood if we are to escape future colds.

The majority of colds are due to infection. They come to you as a gift from your neighbor in the trolley car, who, having a cold himself, generously sprays it about as he sneezes in order that others may partake of the benefits of the stuffy nose.

**W**HILE almost anyone nowadays admits that a cold may be contracted by kissing, surprisingly few realize they are in danger when somebody close to them sneezes without using his handkerchief. But it has been proved that droplets containing microbes may be projected across a room twenty feet wide during the course of ordinary conversation. How far, then, can those same droplets travel when propelled by the high-powered artillery of a lusty sneeze? I recall vividly one such sneeze indulged in by a guest at a social gathering attended by about twenty people. Within the next few days at least half of those present, including a number who were in an adjoining room at the time, were suffering from colds.

The evidence that many colds are of microbial origin is undeniable. At the Rockefeller Institute, in New York City, Drs. Orlitzky and McCartney inoculated nineteen healthy volunteers by swabbing the inside of the nose with the secretion from a man with coryza, the medical term for the common cold. The great majority of these healthy subjects promptly developed a cold.

**T**HE germs responsible for coryza are among the tiniest known. They are ultramicroscopic; that is, they cannot be seen with the strongest lens of the microscope. Furthermore, they will pass through a filter impermeable to all germs of ordinary size. A drop of water could contain millions of them.

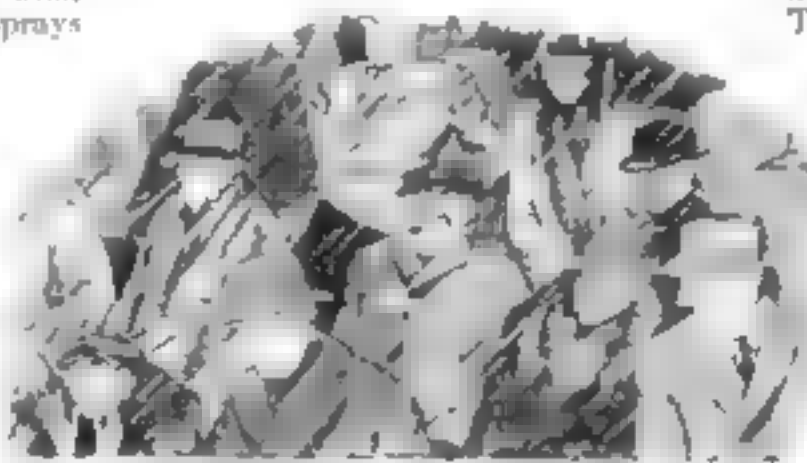
An important fact about the transmission of these germs is that it is only during the first twenty-four hours of the illness that the ailment may be transmitted to others. In other words, if everybody with a cold could be made to stay at home at least the first day, the most important cause of its spread would be eliminated.



The proper thing to do for a cold of any degree of severity. Stay home, stay in bed and send for the family doctor.

Your general vitality seems to play very little part in determining whether you will come down with an infectious cold or not. You may be a champion athlete or a swimmer of the English Channel, but if some fellow with an early cold sneezes the cold germs into your face, the chances are that you will be sniffling before long.

If a lowered state of vitality played an important part in the development of colds, it would be natural to expect consumptives to be highly susceptible. As a



#### If a Drenching by Rain Gives Us Colds—

Why doesn't it affect all of us that way? Of a party of five who recently sat, rain-soaked, through a football game, only one caught cold.

matter of fact, however, patients in sanatoriums for tuberculosis suffer much less from colds than healthy persons. The probable explanation is that the open air life and correct living conditions in the sanatoriums greatly diminish the danger of spreading the causative microbes from one person to another.

A great deal has been said, written and done about preventing colds, but little has been accomplished. Woolen underwear, galoshes, and draft-proof bedrooms certainly will not stave off colds. Cold showers have been shown to be without value in this respect. Vaccine treatment is illogical, inasmuch as vaccines have been proved to prevent only such diseases as do not occur a second time in the same individual, as typhoid, for example.

**T**HERE is only one way to prevent colds, and that is to keep the other fellow from treating the whole crowd to the microbes from his nose and throat. To this end, the surest prevention is to avoid overcrowding in street cars, movie houses and other public places and educate the indiscriminate cougher and sneezer to the proper use of the handkerchief.

So long as people continue to be generous with their microbes, colds will be unavoidable. The fear of drafts and wet sidewalks and the utter contempt for germs as causes of disease seem to be fixed habits of thought in the average mind.

Just the other day I saw a young mother carefully bundling a small boy up in woolen sweaters, coat and muffler as if preparing him for a flight with Commander Byrd over the North Pole. The little fellow apparently felt too warm and objected strenuously.

"Now don't take those sweaters off," she admonished. "You have a bad enough cold already."

At this juncture, another child came out on the porch.

"Let brother have your whistle," continued the mother to the wearer of the bundle of sweaters; whereupon the latter took the whistle out of his mouth, added a few coughs and sneezes, and handed it to his brother, microbes and all.

The use of the common drinking cup is a prevalent source of danger. I know of a family which complains of a continual round of colds, yet never seems to consider that these colds may be passed from one member of the family to another by using the same glass in the bathroom. The lips that touch the rim of the glass leave germs there for succeeding drinkers. And it is this unthought generosity that keeps the doctor's telephone buzzing.

**M**OST of us use the word "cold" in entirely too free a sense. Strictly speaking, the term should be applied to the congestive, watery and discharging condition of the mucous membrane of the nose that medical men call coryza. It is true that the common cold may extend down to the throat and into the bronchial tubes. But I have heard persons speak of influenza and even pneumonia as "bad colds," whereas they are entirely distinct diseases. The

person with a severe coryza, or common cold, may feel about the same as the fellow with the "flu"; but to the doctor these two ailments are separate diseases that must not be confused. The person who takes it for granted that his illness is nothing more than a cold may really have influenza, pneumonia, or even diphtheria.

The word "cold" implies that a low temperature has something to do with the illness. The popular use of this term to designate nasal stuffiness is unfortunate, because the public has unduly magnified the importance of exposure.

Colds caught by a bride and her father at the bride's wedding (for example) formed the basis of a suit filed recently in New York. The hall where the wedding was held was insufficiently heated, the complainants charged, and hence they had caught cold!

**T**WO athletic young people of my acquaintance, a brother and sister who live near the seashore, seldom miss their morning "dip" in the icy surf, even on the coldest days of winter. When the snow is on the ground, they run down to the beach with nothing between them and the wintry blasts but abbreviated woolen bathing suits. Yet these human polar bears, and many others like them, do not seem to complain of stuffy noses any more often than the rest of us.

There is no question, it is true, that exposure may in some cases cause a certain amount of unpleasant stuffiness, if only for a short time. (Continued on page 122.)



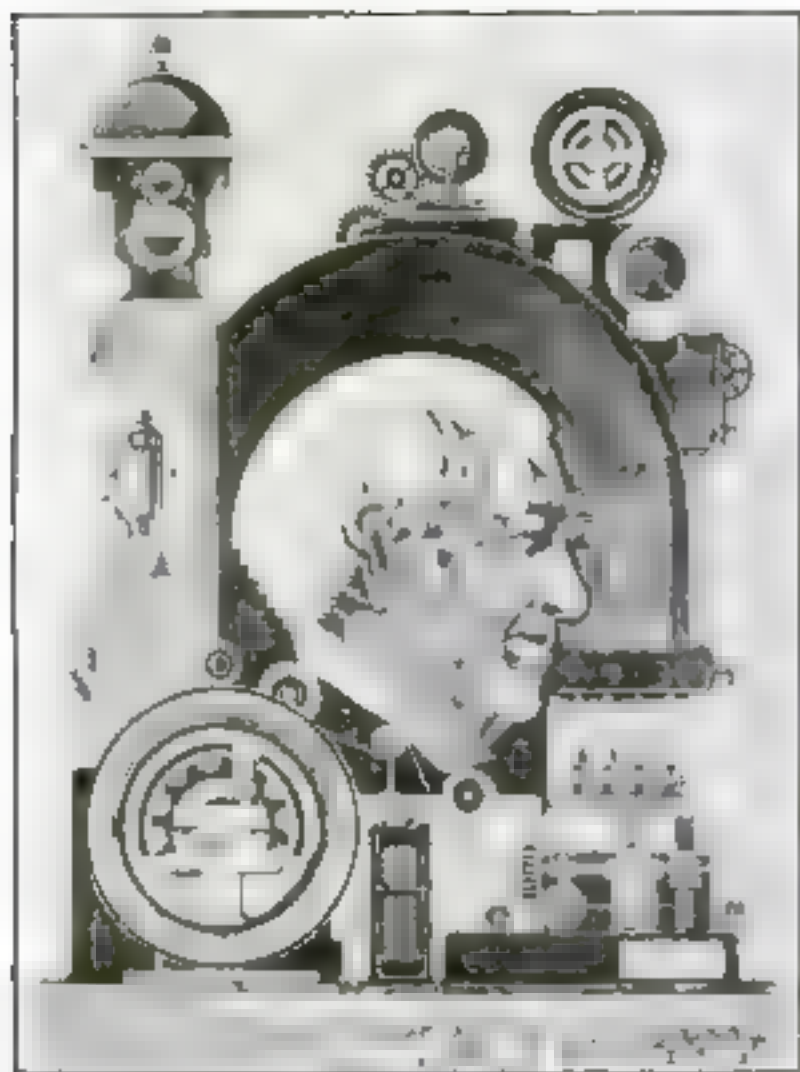
Sweating—a time-honored remedy—is induced effectively by hot lemonade and scorching baths before going to bed at night.



# Edison, at 79, Active while World "Catches Up"

## *Invents Novel New Phonograph Record That Plays Forty Minutes*

By ALDEN P. ARMAGNAC



Courtesy The New York Sun

Thomas A. Edison as he impressed an Argentine artist—this strange portrait being made up entirely of parts of inventions which made the untired famous.

**W**HHEELS and cogs, pumps and dynamos—these were the parts of a remarkable impressionist portrait of Thomas Alva Edison sketched a few weeks ago by Rafael, Argentine artist.

"All mechanical," was Edison's amused comment as he smilingly accepted the artist's gift of the portrait. "No soul!" He turned to his secretary, W. H. Mendowcroft. "Hang it upon the wall," he said. Then he returned to work.

Was the artist right? Is this great man a mechanized venting machine, stripped of ordinary human emotions for the sake of mechanical efficiency? Can his life be summed up by an alphabetical list of the more than 1500 patents that bear his name? I think not.

Thomas A. Edison is not "a machine," despite the terrific concentration that marks his hours in the laboratory. He is a most human individual, and one who thoroughly enjoys life. He has a delightful fund of dry humor.

Recently, for example, the great inventor was reported by an interviewer to be working on a loudspeaker for the receiving of "spirit messages." For a long time Edison evaded answering questions about it. At length he told the story.

"That man," a friend quotes him as saying, "came to see me on one of the coldest days of the year. His nose was blue and his teeth were chattering. I really had nothing to tell him, but I

hated to disappoint him, so I made up the story about communicating with the spirits. It was all a joke."

It is true, however, that Edison fritters away few waking hours in pleasures. He calls himself 145 years old, for, he says, the average man would take that long to put in as much work as he has done in his seventy-nine years. Day

after day, crowded with experiments, finds him in his laboratory fourteen, sixteen and even twenty hours at a stretch.

His unrelenting passion for experiment dates back to boyhood. At six years of age, he tried to hatch goose and hen's eggs by sitting on them after the manner of the mother bird. Later, at ten, he succeeded in persuading one of his chums to swallow quantities of Sniditz powder, confidently expecting that his boy friend would rise like a balloon and float through the air. The results Edison describes as disappointing to himself and highly distressing to the subject of his experiments.

Eventually he managed to amuse something in the nature of a chemical

laboratory. All of his chemical bottles he labeled "Poison," whatever their contents, to insure that they be left alone in his absence. His first laboratory was in his mother's cellar; his second, the empty overhated smoker of the train on which he sold papers to pay for his experiments. Here he succeeded in setting the train on fire when some phosphorus upset, and in his unceremonious departure he received a box on the ears from the conductor that left his hearing permanently impaired. Edison always took this philosophically, as an unavoidable accident not worth mulling over.

After his meteoric rise into fame, new experiments still occupied first place in his mind. A notoriously poor business man, he understood himself well enough to insist that the \$100,000 he received for his telephone transmitter he paid him in seventeen yearly installments, for the life of the patent. He knew that if he received the entire sum at once, he would spend it all immediately—not on himself, but for research.

**N**EVER satisfied to rest, his mind is always busy with some new problem. The amazing story is told of how Edison never saw the Woolworth building, most striking feature of New York City's skyline, for years, though he passed near it frequently. It is this power of concentration that has enabled him to give mankind inventions which, in their present development, are valued at \$15,000,000,000!

His latest achievement, the forty minute phonograph record, gives an entire program of dinner music without the need of changing records. In the twelve inches of its diameter there travels a spiral groove as thin as a human hair and a mile and a quarter long. Today, on the eve of his eightieth birthday, he feels that in electricity we are only just beginning, are on the threshold of a wonderful new age—one in which man's hardest work will be done when he pushes a button.



Edison's newest invention, a forty-minute phonograph record, with the special reproducer that must be used with it is being demonstrated here by Charles Edison (left, son of the inventor) and Arthur L. Walsh, vice-president of the Edison organization.



# Automobile Magic — How

A Picture Story of Mechanical Wonders Inside an Auto Factory, Where Steel Is "Almost Human"

2. **Rolling mill**—The first of the big machines in the steel mill. It is used to roll the steel into the shape of a sheet. The mill is made of heavy steel and is driven by a large motor. The steel is fed in from the left and comes out on the right. The mill is a very important part of the steel-making process.



1

3



4



5

5. **Rolling mill**—The second of the big machines in the steel mill. It is used to roll the steel into the shape of a sheet. The mill is made of heavy steel and is driven by a large motor. The steel is fed in from the left and comes out on the right. The mill is a very important part of the steel-making process.

6

6. **Rolling mill**—The third of the big machines in the steel mill. It is used to roll the steel into the shape of a sheet. The mill is made of heavy steel and is driven by a large motor. The steel is fed in from the left and comes out on the right. The mill is a very important part of the steel-making process.



Photo made by A. H. Jones. Photo Brothers, Inc., Chicago. Copyright 1927 by L. Sears



# Your Car Is Built

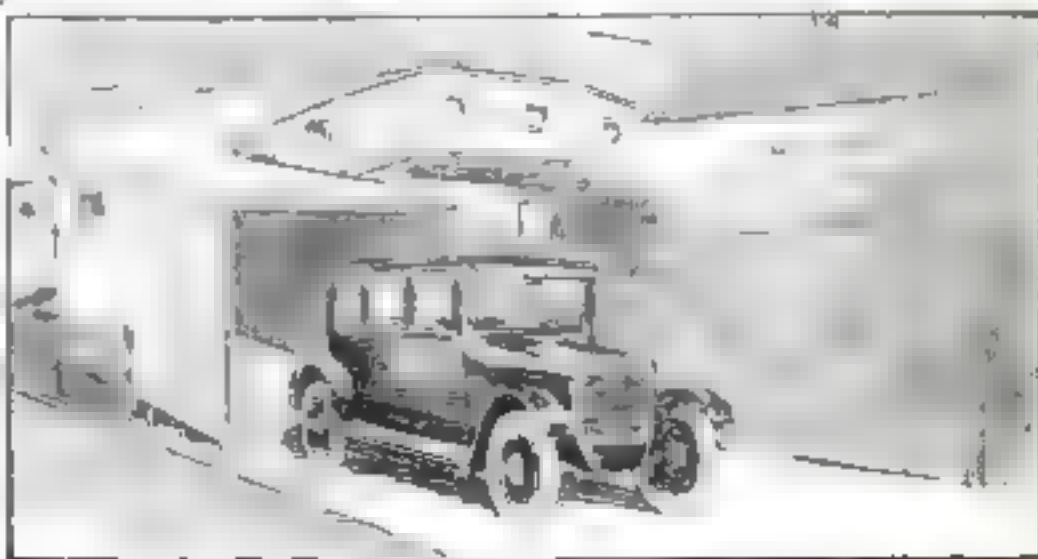
**8** In the case of four are bolted, he raises, with springs all, when out of the sun he has mounted. How these are brought together in the second stage of the assembly is pictured below. Note how the wheels are mounted within the rails of the assembly on an iron track.

**7** The car body is raised above the top of the page is the fourth in the series. It is shown in the picture as being raised by a crane. The car body is shown in the picture as being raised by a crane. The car body is shown in the picture as being raised by a crane.

**9** The car body is raised above the top of the page is the fourth in the series. It is shown in the picture as being raised by a crane. The car body is shown in the picture as being raised by a crane.

**10** When the completed chassis move along continuously mass assembly line, as shown in the picture, the body of the car is lowered into the chassis. The body is lowered into the chassis. The body is lowered into the chassis. The body is lowered into the chassis.

**11** Complete except for headlights and license plates the finished car is driven out of the factory under its own power. It is then given a road test in a special track for a final tuning up and sent out with a clean bill of health ready for a buyer.







### Under Its Magic Spell

Scientists have found that the same mysterious power which the Hindu snake charmer uses makes us work faster and with less fatigue. In this New Jersey electrical factory the girl operators fingers fly in rhythm with lively phonograph music.



*New Things We Are Learning About*

# The *Mysterious* Power of Music

By  
EDGAR C. WHEELER

We Can Work Harder, Think Faster and Feel Happier  
to Quick-Rhythm Tunes—A New Aid in Hospitals,  
Industrial Plants, and in Our Homes

**A** FEW weeks ago I was visiting at the home of friends, when the hostess suggested playing a few selections on their new phonograph.

"But first," she said, addressing me, "how do you feel?"

"First rate—but why do you ask?" I replied, somewhat astonished.

"Just so I'd know what selections to play! Here, let me show you what I mean," she added, opening the doors of the phonograph cabinet. On each shelf, containing a number of records she had pasted a little type-written label. The first one I examined read something like this: "Play when life grows too monotonous, stir you up." I glanced quickly through the records on that shelf. One was the "Toreador Song" from *Carmina* sung by a baritone and chorus. Another was the "Marsellaise" played by a military band. A third was "Keep the Home Fires Burning."

On the next shelf the label read: "Play when worried, brings you peace of mind." Typical of these records were the "Meditation" from *Turks* by Massenet played by Albert Spalding, violinist; "Home, Sweet Home" sung by Anna Case; and a dance orchestra waltz entitled "My Isle of Golden Dreams."

Still other shelves bore classifications such as: "Play to

stimulate new ideas, imagination and invention." "Play when gloom, makes you joyous." "Play when in wistful mood." "Play for more energy." Love songs and selections for children had separate shelves.

"Where did you get the idea?" I asked.

"It wasn't my idea. A musician friend showed me how to select the records and classify them. You may not believe it, but the system works like a charm!

However I may feel at the end of the day—tired, gay, nervous or whatnot—I can always pick out the right music to pep me up or quiet me."

Like most other people, I usually take my music as it comes, good, bad or indifferent. But here was a novel idea. It interested me. The next day I made some inquiries, and I discovered that its originator was none other than the greatest of American inventors, Thomas A. Edison. I found that Edison was a pioneer in the new science of applied music.

## Has It Happened to You?

**H**AVE you ever come home, fagged out at the end of a wretched day, and dropped into a chair with your head so awheel that it seems about to fly to pieces? Distractedly you reach for the radio dial. There comes to you a song, swinging slowly, soothing. Your muscles relax. You find yourself humming. The tune changes—a stirring pated march. Before you know it you are tapping the floor with your feet. When it is over, some where, in the quick, rhythmic strains, your troubles have vanished.

Though we are only beginning to understand this mysterious power, already, as Mr. Wheeler tells, amazing examples of its utilization are found. Hospitals, industrial plants and men as individuals are choosing and using music today on the basis of its astounding and scientifically proved effects.

**A** FEW years ago, when the new marvels of multiplying music by radio, talking machines and piano players were placing the best artists in our homes, Edison came to the conclusion that this great mass of unsorted music should be sorted out scientifically and put to intelligent use. People, he thought, would welcome some guide for choosing the kind of music that would meet their mental, physical and emotional needs from day to day. He engaged the services of a leading authority on applied psychology, Dr. Walter V. Dill-Beggs, then associated with the Carnegie Institute of Technology. With a number of associates, Dr. Dill-Beggs undertook a series of remarkable tests.

Taking 389 different musical







# Home Owners Report Remarkable OIL BURNER Results

*Nation-Wide Survey by Popular Science Institute of Standards Shows None Willing to Go Back to Coal*

**I**N LINE with its aim to give the readers of POPULAR SCIENCE MONTHLY maximum service, the Popular Science Institute of Standards recently undertook the most comprehensive investigation of oil burners that has yet been made. Investigators have gone into nearly 1300 homes in widely scattered sections, where oil burners are actually in operation, to determine the comparative value of various makes of oil burners in relation to each other and to the coal-fired furnace.

As this is being written, preliminary reports covering a large part of the East, Middle West and Pacific coast sections of the country have been tabulated. Both large and small towns in representative communities of home owners have been studied. Amazing facts already have been brought out in this country-wide investigation.

The Institute's investigators gathered information without prejudice or bias. They were after the cold, hard facts of oil burner operation from the viewpoint of the owner; consequently, it is possible to draw definite conclusions from their reports as to what you may expect from an oil burner installed in your own home. The table on this page shows what the investigators have found out so far.

Undoubtedly the most astounding feature of the investigation is that up to date the men who are making it have been unable to find a single owner of an oil burner who could be induced to go back to a coal fire to heat his home. Out of 1247 home owners, not one would go back to coal—and this despite the fact that many of the owners have had trouble with their oil burners at some time or other, as indicated by the number of service calls tabulated in the list. Evidently the most unsatisfactory oil burner gives more uniform heat and less trouble than a coal fire when it is working at its best!

**T**HE tabulation shows 101 dissatisfied oil burner owners. This amounts, roughly, to one out of eight of the people investigated.

In all cases, however, it must be remembered, satisfaction depends on the viewpoint of the individual owner. One owner, for instance, might say that he was perfectly satisfied with his oil burner although he may have had occasion to call for service several times during the winter. Others were dissatisfied when by their own admission they had had only one service call in more than a year. And al-

though it is generally agreed that atmospheric oil burners cannot give the highly perfected heating service obtainable from the more expensive mechanical draft types, it is interesting to note that a normal percentage of atmospheric burner owners reported complete satisfaction.



## What the Survey Shows

Total number of burner installations investigated . . . .	1247
Satisfied owners . . . . .	1086
Total years of service for burners investigated . . . . .	3055
Total service calls for these years of service . . . . .	2212
Owners reporting unsatisfactory service . . . . .	97
Owners not disturbed by noise . . . . .	1149
Noise objectionable . . . . .	98
Operating cost more than coal . . . . .	258
Owners willing to shift back to coal . . . . .	NONE

They had not expected too much!

The heating comfort that any oil burner can give depends first on the ability of the burner to operate perfectly over long periods of time without attention, and, second, on how quickly the local representative of the oil burner manufacturer gets on the job and fixes things when a breakdown does occur.

The investigation is bringing out some startling facts along these lines. The 1247 burners examined so far have been in use a total of 3055 years. This is equivalent to the continuous operation of one oil burner since before King Solomon built the Temple of Jerusalem! And in that vast total of years of heating comfort there have been only 2212 calls for service. This approximates only one call for each sixteen and one half months of operation; not a bad record, especially when we consider that it includes large numbers of trouble calls that were caused by oil tanks unexpectedly running dry and similar difficulties for which the oil burning equipment certainly was not to blame.

Only ninety-seven owners reported unsatisfactory service. This speaks well for the care with which the manufacturers of

oil burners have built up their organizations of representatives, and it emphasizes the importance of buying your oil burner from a reliable dealer who is competent to give you quick and satisfactory service if anything should go wrong.

In fact, the experiences of users of one particular make of oil burner show what superlatively fine service can do to keep customers satisfied. Although this burner leads the list for number of service calls required and trouble from unreliable operation, each owner reported that the service organization seemed to be prepared to go to almost any lengths to keep the burners in constant operation. Trouble calls at any hour of the day or night have been taken care of immediately. Consequently, a far larger percentage of these owners are satisfied than would have been the case if the service had been below average.

**A** GREAT many readers have written to POPULAR SCIENCE MONTHLY for information about the noise produced by the mechanical draft type of oil burner. They have heard, or are under the impression, that oil burners are noisy. That idea is not substantiated by the results of the investigation. Less than eight percent of the owners of oil burners reported that the noise is objectionable. This small percentage included a number of

installations, so the investigators report, which had been made under conditions where the slight noise produced by the burner was magnified by the peculiar construction or arrangement of the house.

The majority of oil burner owners reported that the cost of operation was equal to or less than when coal had been used. A fair number reported an increase in cost compared with coal, but in nearly every case where an increase was reported, the owner agreed that the increase was more than made up for by the additional heating comfort that the oil burner gave him. In many instances it was found that the extra cost was because the house was now kept at a comfortable temperature all day long, whereas when coal had been used the house was cold much of the time because of the attention required by a coal fire.

The Popular Science Institute of Standards is at your service to help you solve your heating problems. For information and advice about oil-burning equipment for your home, write to the Popular Science Institute of Standards, 250 Fourth Avenue, New York City.



# He *SPEEDED UP* the WORLD

*The Story of a Boy's Fight for His Idea  
Against the Greatest Railroad  
Minds of His Time*

By H. C. NORTH

A LOCOMOTIVE whistle shrieked in sharp warning. Brakes grated, smoked and groaned. Coaches jostled each other angrily, straining at their couplings, threatening to break from line and stampede across the belts. Puffing, lurching, trembling, the train came slowly and haltingly to a full stop.

The passengers, thoroughly disoriented by the prolonged shaking, rushed to the doors and poured down the steps. Wrecks and derailment were not uncommon in 1860; fatalities were numerous, the sooner one got out of a train that had stopped where it wasn't scheduled to stop, the better. A few yards ahead, the shaken passengers saw the cause of their troubles.

On the track before them sprawled what was left of two heavily-laden freight trains. The locomotives, twisted and crumpled hulks, lay like two huge beasts that had torn at each other until death had come to both. Freight cars littered the track behind each combatant, crushed, upended, distorted. From their broken sides the cars had spewed their cargo over the roadbed and down the embankment. A crew of men was already at work clearing away the ruin.

"What happened?" "How did it happen?" "Anybody hurt?" The foreman of the emergency crew was besieged with a hundred questions.

"Head-on collision," was the laconic reply which seemed to satisfy all corners, and they returned to their coaches to await a clear track.

"The engineers must have been drunk or asleep," remarked a dark-haired, athletically built young man, his thoughtful eyes professionally scanning the wreckage.

The foreman spat and winked wisely.

"Couldn't stop," he barked.

"Didn't the brakes work?"

"Sure, they worked," he said impatiently, "but they didn't work fast enough. It takes time to stop a train. And he turned with an air of superior knowledge to his men, muttering something about greenhorns.

IT HAS been said of George Westinghouse that all his inventions were made to fill some particular need; that his constant watchfulness pointed those needs out to him. And now, instead of fretting about the delay of his train, he puzzled



To a Chance Act  
of Kindness

Perhaps no great invention ever had as strange a beginning as young Westinghouse's. He owed his success to the gentle eyes of a girl he saw only once in his life.

over the problem which the ardent and the foreman's words had brought to his attention. Why should it take so long to stop a train? The engineers had been alert, but, in order to avoid a crash, with the clumsy system of brakes then in use, they would have had to start applying them when a full mile from each other. Obviously transportation would never be safe or efficient until a more practical brake was evolved.

HAND braking, at the time young Westinghouse had its dangers so graphically presented, was laborious as well as hazardous. One brakeman was stationed between every two cars. On a passenger train, when about a half mile from the stopping point, each brakeman would start to turn a wheel on the platform of one of the cars. This slowly tightened a chain which operated the brakes on a single pair of wheels. When the brakes were set, he would repeat his task on the wheel on the opposite platform. The work was dangerous and the result unsatisfactory, for it was impossible to brake the cars with any uniformity and avoid bumping them together. On freight trains the danger was even greater. The brakemen rode on the tops of the cars, where they were exposed to



"IT TAKES time to stop a train," a foreman impatiently explained to young George Westinghouse in 1866. Wrecks were frequent and travel slow. All his life Westinghouse saw particular needs which inventive genius could meet. The result of the foreman's remark was a series of inventions that revolutionized railroad transportation.

being swept off or to falling between the trucks.

To Westinghouse, it seemed that the wreck he now viewed could have been avoided easily if the engineers had had direct control over the brakes. It was upon a mechanism which would set the brakes of every car of a train simultaneously that he next turned his mind.

Though only thirteen years of age at the time, he was not unfamiliar with transportation. He was already the inventor of a car replacer—a cast steel frog for replacing derailed trains—which also had been suggested by an accident. His invention had resulted in a partnership with two older men who furnished the capital for manufacturing the product. He traveled for the concern, and was at present journeying to Troy, N. Y., in the interests of the company.

Several ideas for such a brake occurred to him. One was a device which depended for its power upon the coupling-up of the cars when the steam was shut off. He decided it would be impractical because of the weight of the train. Another idea was the control of all the brakes by means of a chain extending beneath the entire train.

WITH the question still unanswered, he visited Chicago on business. Here, through Superintendent Towne of the Chicago, Burlington & Quincy Railroad he met the inventor of a brake then in use on that road.

"I, too, am working on a braking mechanism," Westinghouse remarked, as they neared the yards to inspect the invention.

The inventor, who up to that moment had been most affable and talkative, immediately stiffened.



"You're wasting your time, youngster," he said shortly. "I know all there is to be known about brakes, and you will find everything is covered by my patents."

"A broad statement," thought Westinghouse, as he inspected the contrivance.

To his surprise, this invention incorporated his own tentative plan of running a chain the full length of the train underneath the cars. It was operated by a windlass which, when attached to the driving wheel, tightened the chain and applied the brakes. Westinghouse, however, considered the contraption impractical from several standpoints.

**H**IS first improvement would have been to attach the chain to a piston which worked in a cylinder beneath the engine. With steam from the boiler the piston could be manipulated to tighten the chain nicely and smoothly. But he soon realized that no engine could carry a cylinder sufficiently large to operate the brakes on a train of more than a few cars.

It next occurred to him, in his persistent searching for a solution, that each car might be equipped with a cylinder supplied with steam from the engine by pipes running through the cars. But this theory was exploded by the impossibility of transmitting steam from car to car without its condensing. Some other power would have to be employed. What it would be, Westinghouse had not the faintest conception.

As he sat poring over the seeming hopelessness of his dilemma one noon he, after his partners had gone to lunch, he gradually became aware that someone was standing near him. Jumping up, he gazed into the startled eyes of a girl who had apparently been awaiting his attention for some time.

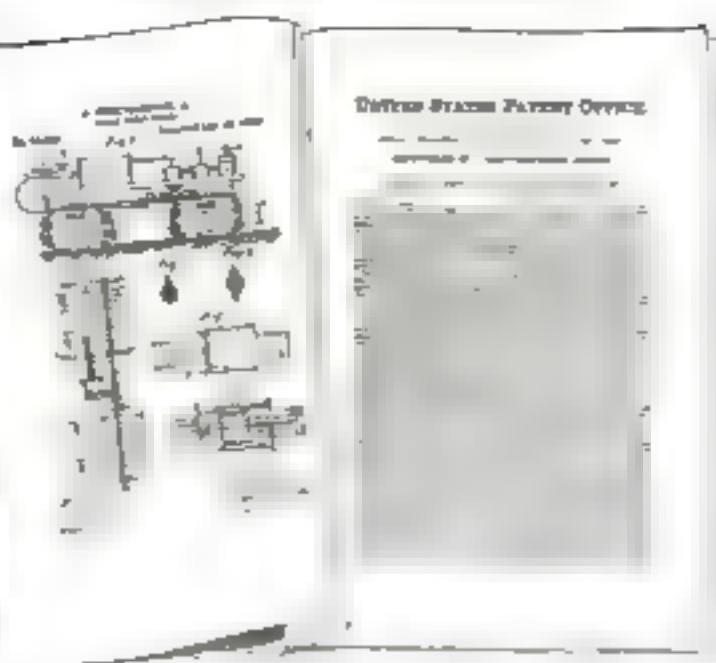
"I am taking subscriptions for the—," she began timidly, extending a magazine which she carried in her hand.

"I don't read magazines," Westinghouse interrupted bluntly, still lost in abstraction and conscious only of the interruption to his train of thought.

"**B**UT, if you—" she faltered, only to meet Westinghouse's mechanically uttered, "Try something else."

"I have," she said so faintly that Westinghouse again turned to her and for the first time really saw her.

He found himself looking into pleading blue eyes, gentle and intelligent, which struggled bravely to suppress tears of discouragement. He was vaguely conscious



Westinghouse's Basic Patent

Above is a reproduction of the first and basic Westinghouse air brake patent, issued April 13, 1868. This first patent drawing represents the high point of the Westinghouse contribution, though other patents along the same lines, of nearly equal importance, were granted later.

that her hair was soft, and that it curled about a face that was fair. His face softened.

"Start my subscription with this number," said Westinghouse, reaching into his pocket and handing her a bill.

The girl departed, never to be seen by Westinghouse again. Who she was, he never discovered. Yet to her blue eyes and gentle manner he was to be indebted the rest of his life.

The magazine arrived and remained unread for days, while Westinghouse busied himself with other matters. Then, one night, he picked the thing up and thumbelily through it. An article "In the Mont Cenis Tunnel," attracted his attention. He dipped into it, found the long descriptive introduction tedious, noted without interest that the country was beautiful, turned another page before

laying it down. He read that page.

The engineers in charge of boring this tunnel in Italy had been forced to abandon steam drills in their work, because the fire needed to generate the steam consumed the air in the shaft. Finally, after experimentation, they had adopted compressed air to drive their drills. It did the work and furnished air for the workmen, as well.

**F**OR a second Westinghouse sat frigid. Then with a shout he tossed the magazine into the air, sprang to his feet, and paced excitedly about the room.

"It'll work. It'll work," he repeated over and over. "If compressed air can drive a drill through mountains, after being conveyed through thousands of feet of pipe, it can apply the brakes on the longest train that was ever made."

There was little sleep for him that night. The next morning he was frantically at work on drawings of the invention which was to revolutionize transportation throughout the world.

But discouragement seems ever to tread on the heels of triumph. It was only a few days after this that his partners approached him with grave faces and announced that they had serious business to discuss with him. With sinking heart, young Westinghouse followed the two older men into the office and, taking his accustomed seat by the window, gazed miserably out into the downpour of rain. There was a moment's silence. Then, after a few awkward remarks, one of the partners addressed the boy.

"As you know," he began pointedly, "our business is almost at a standstill. The sales have decreased and I wear—my eyes are—regretting."

## When This Ship Yawns, It Swallows Whales!



**I**N THE bow of this gigantic California whaler is a huge door that opens wide to receive one of the mammoths of the deep. Water-sealed, it can be swung wide to bring the whale into the hold, where complete machinery for cutting up the huge animal is located. The ship shown, the *C. A. Larsen*, is one of the biggest of these new whalers afloat.

**W**ESTINGHOUSE continued to study the grayness outside. The two older partners exchanged glances. There was nothing to fear; they were dealing with a boy, after all. George stared nervously.

"The sales have decreased through no fault of mine—nor of the replacee," he replied moodily. "Because the frog is made of cast steel, it holds up so well that the railroads seldom re-order."

"Exactly what we were talking over before you came in—and what the other partners' eyes met."

And you suggest—asked George, growing suspicious.

"Well, our profits are too small to split three ways. We suggest that you buy us out."

(Continued on page 132)





### Proposes Thirteen-Month Year

Prof. Charles F. Marvin, director of the U. S. Weather Bureau, who proposes to divide the year into thirteen months of twenty-eight days each. Every month would begin on Sunday and end on Saturday, as at the right. Between December 28 and January 1 an extra day would be tucked in

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

By FRANK PARKER STOCKBRIDGE

**G**EORGE WASHINGTON was born on February 22, 1732. Thirty days hath September, April, June and November.

What's wrong with those statements? Every schoolboy knows they are correct. But—

The first one is all wrong, and the second will be wrong within a few years, unless the present world-wide movement for calendar reform breaks down from some unforeseeable reason.

George Washington was born on February 11th in the civil year 1731. Otherwise the accepted date of his birth is correct. In my own boyhood we were taught both dates; one was "Old Style" and the other and currently celebrated one was "New Style." And the reason for the difference is that in the year 1752 there came a drastic revision in the Christian calendar in that year September had only nineteen days in England and the British colonies of America.

That was a funny year, 1752: it was only eight months and twenty-five days long. There was almost as curious a situation in 1923 in Russia and the Balkan states; that year had only 351 days instead of the regular 365 in the countries where the Greek Catholic Church is the state religion, for the heads of that church changed their calendar in 1923 for the first time since it was established by Julius Caesar in the year 46 B.C.

**T**HAT was the first tangible result of the current movement for calendar reform. What the next will be nobody can forecast accurately. It may be the adoption of the plan proposed by Professor Charles F. Marvin, director of the United States Weather Bureau, to divide the year into thirteen months of twenty-

eight days each, every month beginning on a Sunday and ending on a Saturday, with an extra day tucked in as a general holiday between December 28th and January 1st, and two extra days in leap years. That would be a simple and easily remembered calendar, one that would meet the demands of astronomers and statisticians for more accurate standards of comparison from year to year and month to month. But it isn't entirely satisfactory to the business and religious organizations in Europe and America who are cooperating under the direction of the League of Nations in the effort to find a solution which will near please everybody.

**I**T IS certain that we're going to have, within the next half-century, perhaps sooner, a brand-new calendar by which to make our engagements, compute our statistics, plan our business programs with reference to seasonal matters like crop harvests and the market for Easter fairs, and calculate the dates of coming religious festivals much more easily and accurately than we can do now.

The trouble with the calendar—all calendars including the Chinese, Mohammedan, Jewish and Gregorian—is that the solar system cannot be induced to run on a mathematical schedule. It runs slow at some seasons and fast at others; some years are longer than others and the length of the year is constantly changing. So is the attitude of the earth in space. The North Pole is tilting gradually away from the direction of Polaris toward Vega, which will be the pole star by the year 13,600 A.D. It takes the earth 365 days, five hours, forty-eight minutes and twenty seconds to make a circuit around the sun, while the rest of the solar system

# Wanted— A Brand-New CALENDAR

*Why George Washington Had  
Two Birthdays, and Why the  
World's Dates Need Fixing*

takes twenty minutes longer to cover the same course. But the really troublesome factor is the moon, which revolves around the earth in 29.53059 days. Since earliest times the circuit of the moon (the month) has been made a basis for calendar building, yet its pace bears no determinable ratio to the earth's revolution around the sun (the year) nor to the rotation of the earth on its own axis (the day)—the two other considerations in calendar building.

Every primitive calendar was based almost exclusively on the moon. The Jewish and Mohammedan calendars, by which probably a majority of human beings order their affairs today, are still on a lunar basis. All of the Christian churches fix the date of their principal festival, Easter, by the moon; it is the Sunday following the first full moon after the vernal equinox. The normal date of the latter is March 21st. It is the day on which the sun crosses the equator on its way north, heralding the approach of spring for the northern world. Easter may fall anywhere from March 22nd to April 25th. If the moon and the religious significance attaching to its phases could be left out of consideration, making a calendar which would satisfy everybody would be easy enough. But the computation of a schedule which will reconcile the surplus of ten days and a fraction left after deducting twelve lunar months from the solar year, with the five hours, forty-eight minutes and twenty seconds left over after 365 days have been accounted for in the year, is a mathematical task at which the greatest astronomers balk. They don't even agree on the length of the solar year; some authorities figure the odd seconds as forty-six instead of twenty!

**T**HE approach of the League of Nations to the problem of calendar reform, therefore, starts with the proposal to establish fixed dates for Easter and the Jewish and Mohammedan festivals which now depend upon the moon's phases. Eliminate the moon, and a calendar which would be practically perfect for at least 20,000 years ahead would be a comparatively simple task.

That is what Julius Caesar set out to do in 46 B.C. The old Romans had a fearfully complicated calendar. Everything



was dated from the founding of the city of Rome, *ab urbe condita*. It was twelve months, alternating twenty-nine and thirty days. That made a 354-day year; but the Romans believed odd numbers are lucky, so they stuck on an extra day solely to make an odd number. So far as the moon was concerned, it was a workable calendar, but there were ten extra days a year to be taken care of, so every second year they tacked in an extra month between the 23rd and 24th of February. This extra month was either twenty-two or twenty-three days long and more than took up the slack. The average year thus became  $360\frac{1}{4}$  days long, or about a day longer than the Solar year. To remedy this, in every third eight-year period they put in only three of the extra months instead of the normal four. Thus they reduced the average length of the year over a twenty-four year period to  $365\frac{1}{4}$  days, which was hitting pretty close to the astronomical facts. This calendar, though, proved too complicated for practical use.

**IN ALEXANDRIA**, Julius Caesar met an Egyptian astronomer named Sosigenes. Sosigenes had computed the length of the tropical year—that is, the time between one vernal equinox and the next, at  $365\frac{1}{4}$  days, the very figure which the Romans had reached by juggling months. Caesar engaged him to work out a calendar the ordinary man could understand. The result was the original Julian calendar and the invention of leap year.

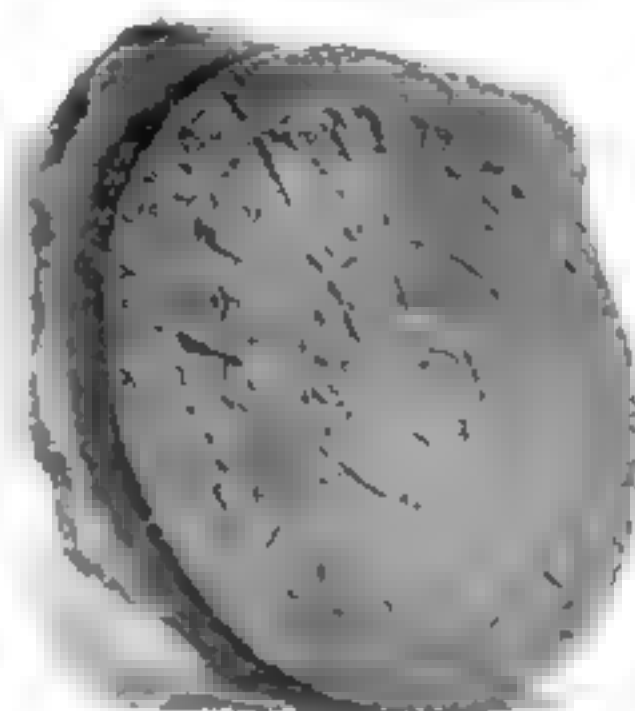
The Julian year had 365 days, arranged in alternate months of thirty and thirty-one days, with one short month, February, having twenty-nine days ordinarily and thirty every fourth year, to take up that odd quarter of a day which Sosigenes had figured out from the stars.

The months corresponding to our present January, March, May, July, September and November were the 31-day months; the others had thirty days.

Julius changed the date of New Year from the vernal equinox, in March, to the first day of January, but kept the names of all the old months except one. That is why we still call the ninth, tenth, eleventh and twelfth months by names which indicate that they are the seventh, eighth, ninth and tenth. September was the seventh month when March was the first, and so on. But the fifth month, which they had called Quintilis,

or Fifth, Julius Caesar named after himself, July. And that started a lot of the trouble we've been having with calendars since. For August is Caesar in 26 B.C., insisted upon having a month named after himself, too, and picked Sextilis, which he changed to August. He insisted too upon having his month just as long as

Julius's. To do this he took a day off February and tacked it to August. But that made three thirty-one day months in a row—July, August and September, so he shifted a couple more days, from September and November to October and December. And ever since the children have had to learn to recite the "Thirty days hath September" ditty.



Calendar Stone of Ancient America

The ancient people of America, like the Egyptians, had astronomers and knew much about calendars. Here is a calendar stone found among the ruins of their civilization. Its hieroglyphs, recently deciphered, reveal that they reached practically the same figure for the true length of the year that we have today.

The Julian calendar as muddled by Augustus worked along fairly well, however, for sixteen hundred years, except that the common people insisted on calling the vernal equinox New Year's Day and calculating their festivals by the moon, so much so that the Fathers of the Christian church at last officially established the date of the equinox as New Year's and the base from which to calculate the date of Easter. In Caesar's time the equinox fell on March 25th. Then in the eighth century A.D. it was discovered that the equinox and the calendar no longer tallied; the sun was crossing the equator a day earlier every hundred years or so.

**POPE SIXTUS IV.**, in 1474, called in Regiomontanus, the most famous astronomer of his time, to discover what was the matter. He died before he got the answer. It was not until more than a hundred years later that men of science were able to tell Pope Gregory XIII that

Sosigenes's calculation of the length of the year had been eleven minutes and fourteen seconds too long, and that this figured out to practically three whole days every four hundred years. The remedy was the simple one of dropping three leap years in every four centuries. Gregory issued a Papal brief, in March, 1582, ordering that thereafter years ending in two ciphers should not be leap years unless their numbers were divisible by 400. The year 1600 was a leap year, but 1700, 1800 and 1900 were not; 2000 will be. In addition to that, however, he directed that the year 1582 should be shortened ten days, by dropping all dates between October 4th and 15th, and that the Julian New Year, January first, should be counted as the beginning of the year. This restored the date of the vernal equinox to March 21st.

**THE** new calendar went into immediate effect in every Roman Catholic country. The Greek Catholic church, dominating Eastern Europe and all Russia, would have nothing to do with it. Neither would the Protestant states of Germany for a great many years. Scotland, then a Catholic independent nation, adopted the Gregorian calendar, and the Scottish year 1600 began on January first, but England stuck to the Julian calendar until 1752. As the year 1700 was a leap year in the Julian calendar but not in the

Gregorian, the difference between the two was, by that time, eleven days. By an act of Parliament, eleven days were dropped from September in that year, the day following September 2 was designated as September 14. At the same time the year 1752 was further shortened, to eight months and twenty-five days, by the designation of the following January first, instead of March 25th, as the official beginning of the new year. Old documents executed in the period between January 1 and March 25, 1753, frequently bear both dates, old style and new style, as "February 11/22, 1752, 53."

**WHICH** explains why the birthday of George Washington, then twenty-one years old, may be written either as February 11, 1731 (old style), or February 22, 1732 (new style). In the strictest sense, the currently celebrated date of Washington's birthday is wrong.

The Gregorian calendar which we use today is calculated to run without change

for 3,430 years. Its average year over each 400-year period is between 24 and 25 seconds longer than the actual astronomical year, so that somewhere around the year 5038 A.D. another day will have to be dropped from the calendar to keep the vernal equinox from slipping back to March 20th. If there were no other (Cont'd on page 124)

JANUARY				APRIL			
JULY				OCTOBER			
S	M	T	W	T	F	S	
	1	2	3	4	5	6	
7	8	9	10	11	12	13	
14	15	16	17	18	19	20	
21	22	23	24	25	26	27	
28	29	30					

FEBRUARY				MAY			
AUGUST				NOVEMBER			
S	M	T	W	T	F	S	
			1	2	3	4	
5	6	7	8	9	10	11	
12	13	14	15	16	17	18	
19	20	21	22	23	24	25	
26	27	28	29	30			

MARCH				JUNE			
SEPTEMBER				DECEMBER			
S	M	T	W	T	F	S	
					1	2	
3	4	5	6	7	8	9	
10	11	12	13	14	15	16	
17	18	19	20	21	22	23	
24	25	26	27	28	29	30	
31							

#### Allows Twenty-Six Business Days Each Month

The "New Era" Calendar devised by Prof. L. A. Gronlund of Switzerland is highly favored in Europe. It is arranged so that a given date would fall always on the same day of the week every year. The calendar would have 364 regular days in the year, with an extra holiday not shown in the calendar. One of its chief advantages, from a business standpoint, is that every month would have exactly twenty-six business days, exclusive of holidays.



## More Picture Prize Winners

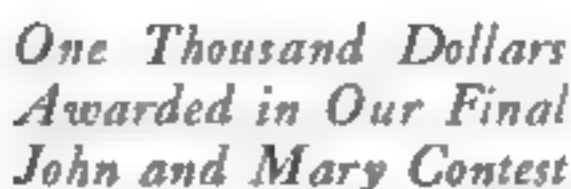


## FIRST PRIZE

W V Chambers, Swarthmore, Pa., wins the first prize of \$500 in our final John and Mary Picture Contest. "Aside from the pleasure derived," he tells us, "I think I gained a pretty good idea of what not to do in laying out a retailer." Mr. Chambers is an illustrator. His hobbies are radio, tennis and modern literature.

## SECOND PRIZE

Herbert Kelsey Gault, Baltimore, Md., winner of the second prize of \$100, shown in the photograph at the right with Mrs. Gault, is a Boy Scoutmaster. Another of his hobbies is to make something useful out of old junk.



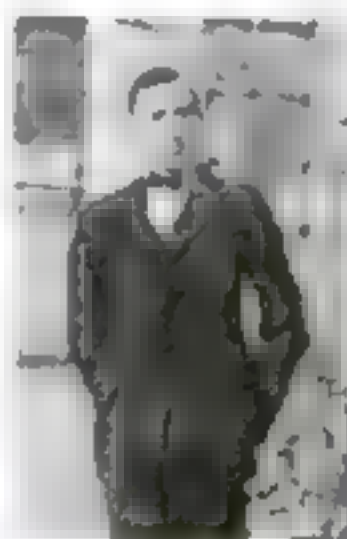
### THIRD PRIZE

"This interesting contest has taught me to study the things about me more intently," writes W. O. Freund of Newark, N. J., winner of the \$50 third prize. He started at a given point in the picture and worked around it examining every object. He is a power sub-station operator. His hobby is building and repairing radio sets.

### *Some of the Other Successful Contestants*



T... ..  
f... ..  
... ..  
... ..  
any ... ..  
L. W. Abing... ..  
found ... ..  
A... ..  
... ..

[illegible]

A: On the way from Hanoi to  
Hue, the policeman stopped us.  
Q: What did he do?  
A: He asked us to stop for a  
moment and wait a prize for  
him.



Radio ads often are representative  
of the space that a company has.  
Rise & shine, singing in the Texas.  
He is a very busy man. The  
car was a real hit. It was a hit.



Arthur R. W. Jager and  
George N. Y. He  
were among the  
first to be  
killed in the  
battle of the  
Marston.



Another young winner is Andrew Evans, Jr., sixteen, of Homestead, Pa. With his prize money he expects to purchase tools to improve his hobby of making things.

Edward S. Crockett, an attorney of Boston, Mass., found that when he studied the contest just before retiring at night, additional mistakes came to him readily the next morning.

**T**URN to page 137 for the complete list of prize winners in our final Picture Contest which appeared last August. And don't miss the fascinating Automobile Contest on page 62 of this issue.

Fang sings and making him work right is the favorite pastime of Arthur L. Kaser of Mishawaka, Ind., a writer by occupation. That he says, is why the Picture Contest strongly appealed to him.



The picture of Mary at work in the laundry especially appealed to Charles A. Garrison, who is a plumber and steamfitter at Nyack, N. Y.



# Is Your Home Lighted for



A modern well-lighted living room—with the twin enemies, gloom and glare, abolished

"**H**OW much light do we need for our house?" asked Ellen.

"How long is a piece of string?" I countered.

"Do you mean to say," retorted the attractive young woman who is mistress of a brand-new house, "that there is no truth in the claim that lighting has been revolutionized since the days when Abraham Lincoln read books by the flare of a pine knot in the fireplace?"

"Lighting engineers have given us new ideas and inventions, and there has been progress, yes. But there's been no revolution. The glowworm still makes man's best lighting system seem primitive. The human eye is the most wonderful light-adjusting machine we know of."

"That's too mystical for me," grinned Rob. "Here's something more to the point—I have a grievance against our electrical man."



Wedge-shaped electric outlets at convenient points were stopping to connect up lamps or appliances

In my absence he went ahead and put in about twice as many electric outlets, with BX cable throughout, as I expected. What in the world am I to do with them all?"

"If he had put in too few outlets, and used knob-and-strap instead of cable, you would have a legitimate cause of complaint," I replied. "As it is, you are lucky he did it. The surplus outlets and cable are no expense beyond the moderate first cost. And you will soon discover the great advantage of plentiful outlets, especially for connecting up your portable lamps; they will no longer be surplus but essential, useful in a dozen ways. With few outlets, people are inclined to have makeshifts of extension cords,

## ARE YOU PLANNING TO BUILD?

*MR. McMAHON'S services and those of the Popular Science Institute of Standards are available to assist our readers in solving their building problems. Letters will be answered free of charge. Write to the Home Service Department, Popular Science Monthly, 250 Fourth Avenue, New York City.*

which are inconvenient and dangerous, though of course useful in homes inadequately wired."

"We have only a few lighting fixtures as yet," said Ellen. "In fact, the house is only about half decorated or papered, though we're living in it."

"So much the better for planning the lighting layout," was my comment. "If you had everything bought and done it would cost more to change it. I am glad you mentioned decoration and paper, because that is really half the problem of lighting. A gloomy-muddled interior decorator can just about completely nullify Edison's chief invention, the incandescent lamp."

"**C**AN'T you start us off with the A B C's of this lighting subject?" inquired Rob.

"Well, to begin with, the Bureau of Standards at Washington has the basic unit of light, which is termed one candle-

## Points to Watch in Choosing Your Lamps and Fixtures—Don't Stint on Wiring

power. Such a light falling on one square foot of surface at one foot distance is called one foot-candle, and is also termed one lumen. Since light disperses equally in all directions, the total output of one candlepower at one foot distance is 12.57 foot-candles or lumens; that 12.57 being the square-foot area of a sphere of one-foot radius. We are speaking of a central unshaded light.

"The farther from the source the less light, since the same amount spreads over a greater surface. Candlepower divided by distance squared equals the actual illumination you get at that distance."

It is enough, however, for the average person to have just a glimmering of these fundamentals, in order to read and understand the manufacturer's worked-out tables of illumination.

"Then there are tables for proper lighting, that we could follow?" asked Ellen.

"**Y**ES, but the standards are rather offhand and arbitrary. The fact is, man, accustomed to sleeping at night, is stilliggardly of artificial illumination and gets along with the least possible. He thinks he is doing well with a 50-watt lamp which at one foot distance has only about one twentieth the intensity of sunlight. He used to worry along with a kerosene lamp of 1/1025th the power of sunlight, and before that with a candle equal to 1/10,000th part of sun illumination."

"How many of those light units—lumens—are there in a watt?" asked Rob.

Eight to ten in the ordinary home

## Two Views of the Same Kitchen.



Note how the housewife is forced to work in her own shadow when the only light comes from a lamp hanging from the ceiling



# Beauty and Comfort?

By JOHN R. McMAHON

lamp. They increase a few as the wattage rises, so that a 100-watt lamp may contain 1300 lumens. It is perhaps more practically important for you to know that heat increases with light power. A 30-watt bulb reaches 262 degrees Fahrenheit, while larger sizes exceed 300 degrees.

"Don't, therefore, touch a high-power lamp with your bare hand, nor cover it with cloth or tissue paper, which might cause a fire by confining the heat. Also, follow the manufacturer's directions for placing high-power lamps—they are aimed to protect socket connections from excessive heat."

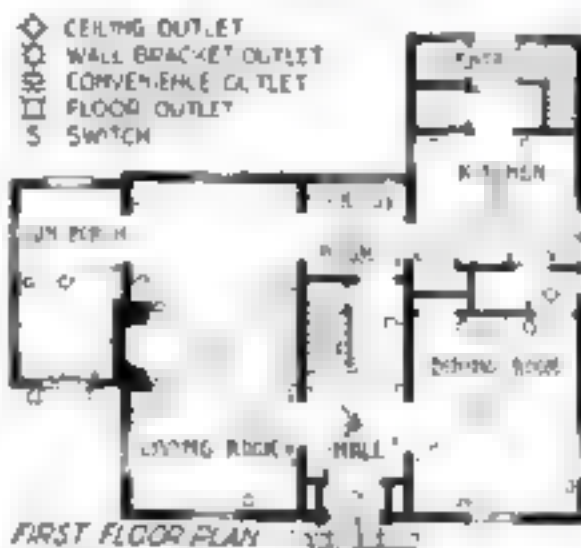
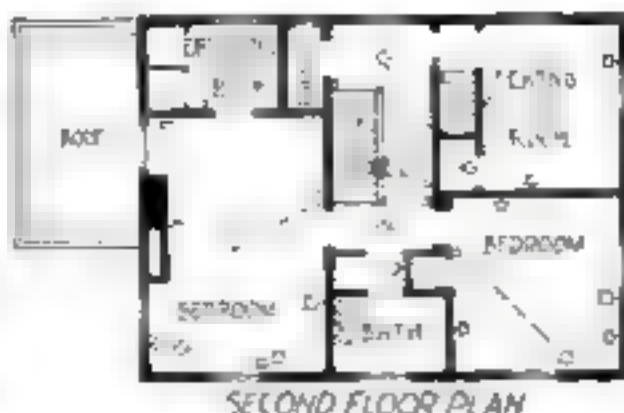
"You say there are eight to ten lumens in a watt," remarked Ellen. "To me a watt is such a vague thing—I'm not at all sure I know what you mean."

"YOUR electric light bulbs will increase your familiarity with the watt family," I laughed. "It is the unit of electrical power. The bills, to be sure, lump one thousand watts into the larger unit of kilowatt or K.W. You must include the time element. A kilowatt for one hour, termed a kilowatt hour is what you pay for—your bills may read, for instance, eight cents per kilowatt hour. You can figure for yourself exactly what each lamp costs while in use."

"The average home lighting fixture, however, consumes only from one fifth to two fifths of a cent of current an hour."

"Before Ellen pins you down to further practical information," said Rob. "I'd like to know more about the lamp-versus-glowworm question that you started with."

"Well, the best vacuum lamp yields as light only about six percent of the energy it receives. If the worm did no better, I imagine it would have to be as big as an elephant and its wings the size of an airplane, to give the same tiny glow. A



Courtesy of Colgate Lamp Co.

Electric wiring plan for a well-lighted home, with symbols explained. "Convenience outlets" is a general term meaning outlets to plug in portable lamps and electrical appliances.

gas-filled lamp puts out eight percent of its energy in light. The lost energy goes off in heat and invisible rays. Incidentally science compliments the worm by saying that its yellow-green light is the necessary color for maximum efficiency."

"ARE all lamps gas-filled or vacuum as the customer prefers?" queried the young woman.

"No, the smaller sizes are vacuum. Gas-filling is at fifty watts and up. The gas, which is argon with a trifle of nitrogen added, permits a higher temperature of filament to be attained which increases light and also retards evaporation of the filament substance."

"I didn't know that the filament would evaporate," said Rob. "It is tungsten, I understand, which is a pretty tough metal."

Yes and it evaporates gradually with incandescence. The process is slow yet the vaporized material condenses and gathers on the bulb interior, darkening it and so decreasing light output. The effect is lessened by the insertion of chemicals in the bulb that keep the tungsten particles from forming a solid mass. Besides this decline in efficiency by darkening, thinning of the filament by evaporation increases resistance, lowers the rated watt consumption and decreases



Two lights flanking the mirror insure an even job in shaving, eliminating shadows.

correspondingly the output of light.

The average standard lamp is now rated to have a life of one thousand hours. You can keep using it into old age on y at the loss of illumination. The manufacturers could make a longer-lived lamp, but it would be less efficient in light and would cost more in current. Throw away the old blackened bulbs and get new ones. Occasionally you will find a new lamp that is defective and fails to serve a full term. Variation of voltage on the power line may shorten lamp life."

"I like the soft light from frosted bulbs," remarked Ellen.

"They are becoming deservedly more popular and in time may displace most of the clear bulbs in home use. We have had two extremes in home lighting, first gloom and then glare, from which we are now emerging. Glare comes from an unshaded or unfrosted lamp whose direct rays strike the eye; also by reflection from polished surfaces, whether enameled, glass painted or varnished. You meet it still in the homes of some otherwise intelligent people. It causes eyestrain, makes jobs for the oculist, and even affects health. Glare is the insidious enemy of eyesight and should be abolished."

"BUT doesn't frosting reduce the amount of light?" asked Rob.

"No, or, rather, so little as not to count. The old-style outside frosting did cut down the output of light, up to one fifth of the total. We now have inside frosting whose maximum absorption of light after long use is only four percent more than clear glass. And the inside treatment makes it easy to dust or clean the bulb outside, which was not the case formerly."

"Inner frosting is done by etching the glass with acid." (Continued on page 138)



Switches near doors make it easy to operate lights when you enter or leave rooms.

## Showing Bad and Good Lighting



Here two brackets throw light down on her work, another fixture lights the breakfast nook, and a fourth the entire room.



This is a test model of a naval flying boat. These marvelously accurate models, aeronautical engineers say, teach them more than hours of actual flight

# They *Test* Planes Now without *Flying*

*Amazing Models, Put through Paces in Wind Tunnel, Solve Riddles of Balance and Speed*

By  
G. H. DACY

**C**LUSTERED about a marvelous electrical instrument in a laboratory in Washington, D. C., a group of engineers eagerly watch the flickering dials. Beneath the floor under their feet, a gale of wind roars through a man-made tunnel. In the center of the tunnel, communicating with the instrument in the laboratory above, is suspended a tiny airplane—a mere toy only two feet in wing spread. Yet on this little model hangs the fate of an inventor's hopes, for it represents a strange new plane of revolutionary design.

Not a life endangerer, nor is a costly giant of the air built only to be scrapped, in this triumph of science the latest way to test new airplanes at the Washington Navy Yard. When an inventor offers Uncle Sam a new idea for an airplane, this method enables tests to be made at a total cost of \$500, as compared with \$50,000 if the actual machine were built. Engineers tell us the amazing fact that they can find out more from these wonderful little models than from many hours of actual flying.

Following the inventor's plans, expert craftsmen in Uncle Sam's workshop carve the diminutive craft out of mahogany. A skilled worker can complete such a reproduction within four days. From time to time as the work progresses, he measures the model and compares it with the dimensions on the large-scale plans. If there is an error no greater than the thickness of a sheet of paper in the wing surfaces, they must be refinished, for the models are reduced in size from twelve to twenty-four times, and a slight mistake in large-scale design becomes magnified to a serious error in a tiny model. Again and again the mahogany plane is checked for accuracy.

**W**HEN it is completed, it is a perfect miniature model of the huge man-carrier conceived by the inventor—except that it lacks a motor and propeller. Now it goes to the proving ground—not to a flying field, but to a dim square tunnel that a man can enter erect with plenty of room



Where Winds Are Made to Order

Interior of the wind tunnel where the Navy tests new airplane designs—one of the largest tunnels of the kind in the world. Sensitive fingers on the end of the shaft grasp the model

to spare. An immense centrifugal fan, twelve feet across and many bladed, is whirled by a 300-horsepower motor. It sends a blast of air through the passage, a cyclonic gust of 100 miles an hour if necessary, circling the 200-foot length of doughnut-shaped tunnel. From the ceiling descends a steel shaft. At its lower tip are sensitive fingers which, grasping the model, will relay to the scientists in the laboratory above news of what happens when rushing air meets plane.

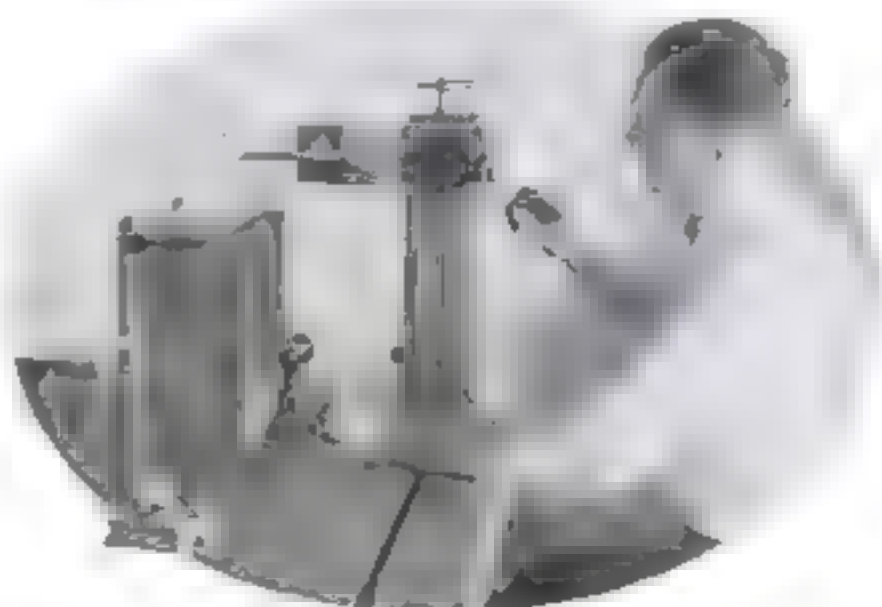
The critical moment has arrived. With meticulous care the toy-size machine is fastened in place on the shaft. The fan roars into action and is set to create a blast of forty miles an hour, standard for these tests.

The shaft, the balance arm of a strange weighing machine, communicates the plane's vibrations to

the remarkable instrument in the laboratory. This machine, invented expressly for the U. S. Navy, is the only one of its kind in existence. A masterpiece of electrical ingenuity, it reveals all conceivable reactions of the baby plane.

**H**OW much the plane will lift; whether it will "skid" in banking for a turn; whether it will fly in a straight line, or veer to left or right; and whether it is likely to take a sudden unexpected nose dive or turn up its nose and stall—these are some of the questions answered by this machine with almost human intelligence. A lift of ten pounds for the model may correspond to a ton and a half in actual flight—a drag of one and one quarter pounds, to four hundred or more on the big plane.

Several hundred new airplane types have been tested in this tunnel since it was opened some years ago, and we are indebted to it for much of our present knowledge of how to build aircraft. Airplane parts are also tested, and models of gas bags for lighter-than-air craft—curious "fish forms" to cut down air resistance. Even the effect of trade winds and storms on mammoth battleships is demonstrated in the tunnel by means of miniature craft and artificial gales.



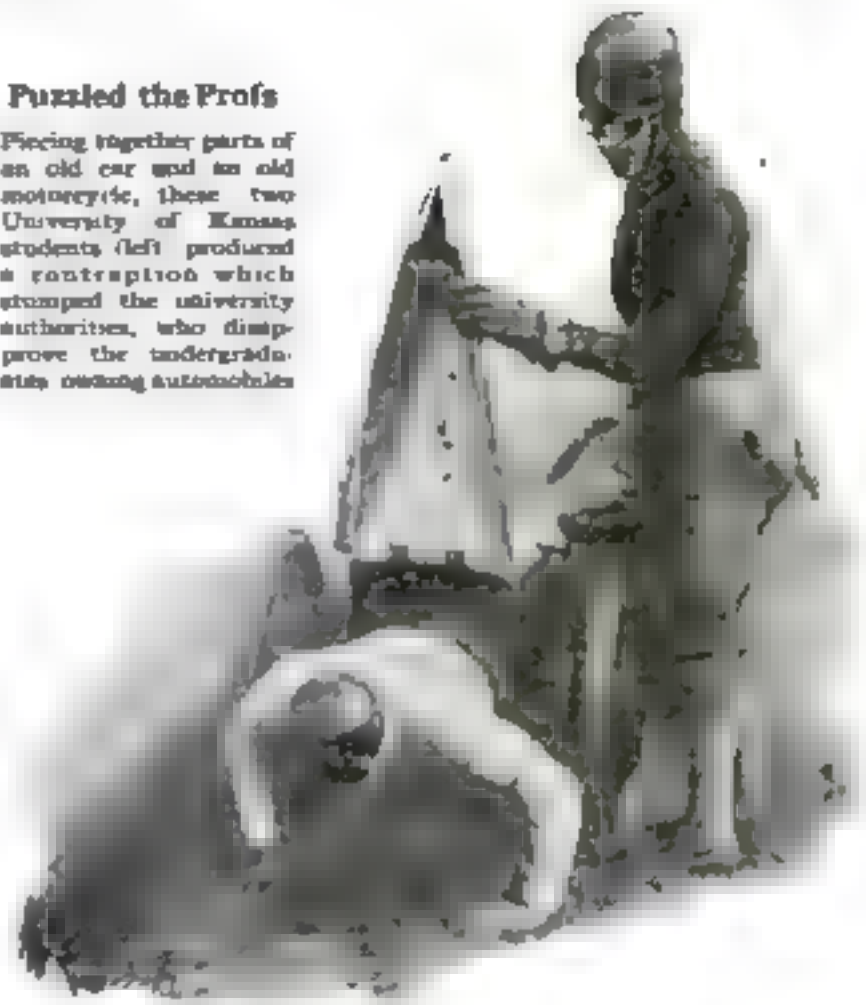
Measuring the wing surface of an airplane model preparatory to testing. Absolute accuracy to the thickness of a sheet of paper is required, for on that depends the whole value of these remarkable tests





### Puzzled the Profs

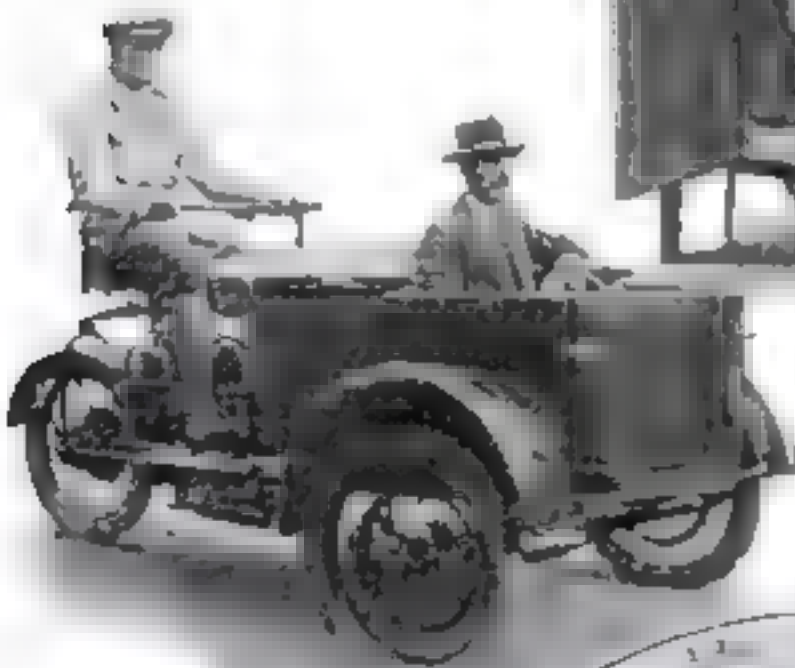
Piecing together parts of an old car and an old motorcycle, these two University of Kansas students (left) produced a contraption which stumped the university authorities, who disapprove the undergraduate's tinkering automobiles.



## Strange Uses of Motorcycles

### Taxis for One or Two

Cabmen of Vienna, Austria, who are averse to paying for a one-passenger rule in their passenger cars, are lowering the number of passengers to one or two. Three wheels, it is said, is a better bet for the busy and frugal than a four-wheeled passenger.



### He Crawls in Backward

Not a sound stable with a driver, the designer would not get all possible speed and not satisfy all requirements of a passenger. Engineers are trying a passenger.



### Rolling Their Own

Motorcycle campers in England are the only campers with their own. The campers are attached to the back of the motorcycle and are sitting at the back of the camp.



### Modern Travel in the Yukon

Dogs and horses and the post-graduate way are being replaced by motor's for winter travel in the Yukon. The motor is a two-wheeled, two-runners and with a chain-drive wheel covers the 275 miles between White Horse and Keno in three days—a trip that used to take a four-horse team twelve days to complete.



### Speed kings of Photography

No time is wasted by the photographers at the Berlin film owning the motorcycle. Photos are taken from the moving tower developed in the dark room of the studio and are ready to be distributed when they arrive at the office.



# Science Blazes

## Serum for Measles, Electrified

### Electricity As Soil "Fertilizer"

Can electric wires imbedded in the soil speed up plant growth? The experiment of raising vegetables by this method on a large scale has been made in Berlin, Germany. Copper wires running through the field a foot deep extend up a row of masts left in points which collect electric charges from the air. As for the results claimed, the little girl is holding a normal beet and one said to have been grown electrically.

pany, is the inventor. "Pallo" and "photo" are Greek words meaning "shaking light."

The device "films" the voice by means of a delicate vibrating diaphragm and a beam of light. When sound waves vibrate the diaphragm, the motion causes the light ray to fall upon a strip of film similar to a moving picture film. The picture-taking machine works in synchronism.

To reproduce the record, the sound film is wound on a reel so that it can be passed in front of an extremely sensitive electrical apparatus, creating an electric current which, amplified, operates a loudspeaker.

### Trailing the First Americans

ALL during last summer a noted American scientist made his way through Alaska wildernesses on a most remarkable journey of discovery. He sought neither gold nor new lands. Instead, he was on the trail of new knowledge about the primitive men who first set foot on the American continent.

That scientist was Dr. Ales Hrdlicka, anthropologist of the Smithsonian Institution, Washington, D. C. Returning from his travels a few weeks ago, he brought back evidence which, he says, establishes beyond doubt the fact that North America's earliest settlers were Asiatic peoples who migrated here by way of the Alaskan peninsula.

### Strange Changeable Animal

AN ANIMAL which can change into another animal and then back to its original form, is the startling discovery, announced the other day, of Dr. Martha Bunting of the zoological department of the University of Pennsylvania.

The "animal" is one-celled, resembling a minute drop of jelly, and belongs to the amoeba family. It can transform



On these pages are presented each month brief stories of scientific discovery and research having practical bearing on our everyday problems.

### Sun Spots Make Us Healthier

A FEW weeks ago the Harvard University Astronomical Laboratory announced the discovery of a terrific cyclone on the sun, evidenced by an unusually great crowd of sun spots.

If you are a radio fan you probably said "There goes the chance of good long-distance reception this winter," recalling the electrical effect of sun spots on the earth. But did you know that this solar storm may, in addition, definitely affect your health for the next year or so?

Dr. Edison Pettit of the Mount Wilson Observatory, California, tells us that the increase in sun spots results in an increase in the ultra-violet rays of sunshine which, besides causing sunburn, aid our bodies to combat germ diseases. When the eleven year maximum of spots is reached within the next year or so, he says, the sun will give off about two and a half times as much ultra-violet light as it did in 1925.

In the same connection the British light-cure expert, Dr. Albert Edinow, has just finished experiments supporting the theory that the health-giving effect of sunlight is due to some substance which the sunlight sets free in the blood. This substance kills disease germs, and its effectiveness varies with the amount of skin exposed to the sun. Too much exposure, however, he says, may do more harm than good.

### Scientists Test Radio Echoes

HOW radio actually travels has baffled even the scientists. Now an answer to the riddle is offered by two scientists of the Carnegie Institution of Washington, Drs. G. Breit and M. A. Tuve. By a strange experiment they appear to have demonstrated that radio transmission depends on a layer of elec-

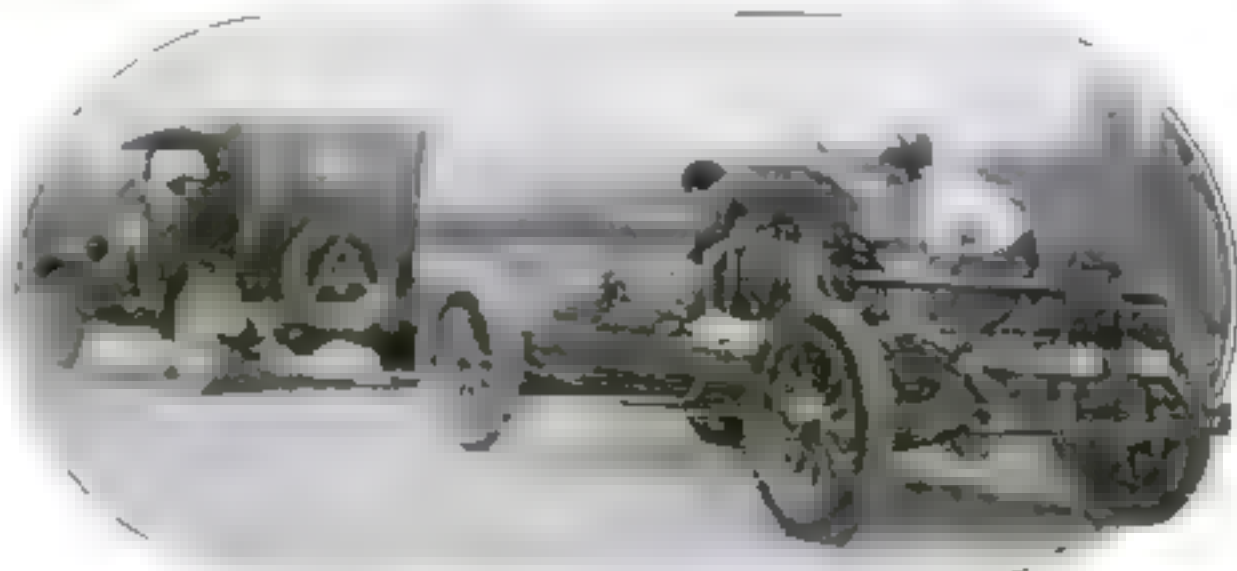
trified air high up in the atmosphere.

The ordinary air we breathe, of course, is not a good conductor of electricity. Light and telephone wires in contact with the air do not lose their current. How then, men have asked, can radio waves travel through air? Scientists have imagined a layer of thin air a hundred miles or so above the ground, so highly electrified that it conducts electricity almost as well as a copper wire.

To prove the existence of this layer, Dr. Breit and Dr. Tuve directed radio signals upward toward it. "Echoes" which, the scientists were convinced, were sent down again to earth by the electrified layer, were detected.

### Voice Filmed for Talking Movies

SOUNDS actually registered on a film, instead of on a wax disk, are the basis of a remarkable new invention, the "palliophotophone," now being developed in the hope that it will mark a new era in talking movies. Charles A. Horn, an engineer of the General Electric Com-



### Testing a Car's Hill-Climbing Power on Level Ground

Though it is traveling on level ground, the automobile above is going through a unique hill-climbing test devised by the General Motors Corporation. It is towing a dynamometer mounted on a chassis, the mechanism being designed to duplicate the terrific drag encountered by a car in ascending steep hills. A hill 1,000 miles long must be climbed, in effect, by a car to pass this test.



# More New Trails

## Farming and Other Advances

itself into a complicated flagellate, Dr. Brinting says, and then effect a re-transformation back into its amoeba state.

In its amoeba phase, as described by its discoverer, the strange animal can round itself up and surround itself with a protective membrane within which it rests.

### Trace Sunken Atlantic Continent

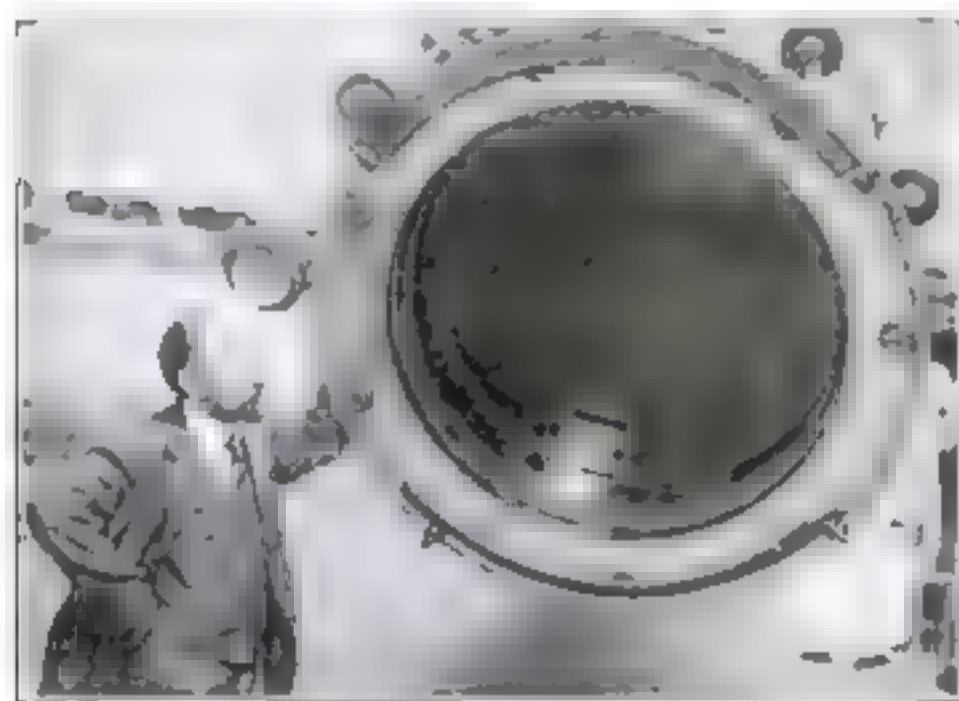
**T**HAT mysterious submerged continent beneath the waters of the Atlantic, already known to geographers, has had its boundaries defined more exactly by recent soundings made by the German survey ship *Meteor*.

The main part of the "sunken continent," these soundings show, lies between the southern tip of South America



Bones of Strange Extinct Elephant Dug Up in California

In a sand pit in California, forty miles from Los Angeles, were dug up the other day teeth, tusks, and bones of the Imperial Elephant, ruler of the animal kingdom more than 50,000 years ago. One of the mammoths unearthed is thought to be the largest of these extinct monsters ever discovered. The photograph above shows one of the tusks, which was badly decomposed, laid out for inspection.



### Mars Swings In for a Close-Up

The planet Mars was nearer to us on October 27 than it will be again for fifteen years, and astronomers everywhere watched the planet closely in an effort to collect further facts that might solve its mysteries. Dr. George Van Biesbroeck, of Chicago, is shown here with the famous Yerkes telescope with which he observed the planet. It has the largest lens in the world.

This goat serum, when injected experimentally into susceptible persons not later than the fifth day after exposure to measles, prevented the onset of the disease in nearly percent of the experiments.

### Not All Birds Shun Divorce

**O**UR idea that birds never get divorces but stick to their first loves throughout life received a rude jolt the other day when S. Prentiss Baldwin, of Cleveland, Ohio, announced the results of a ten-year intensive study of bird habits.

Mr. Baldwin kept a day-by-day record of the lives of a number of household wrens which nested on his estate. These wrens, according to his report, usually raised two broods of young a year. But each year, between the broods, the parents usually changed mates. The mating lasted only while the young birds were helpless; after that the parents felt quite free to make a new marital arrangement.

### Her Feat Was Creating Nothing

**C**HANNEL swimmers and Babe Ruth are not the only ones who have been breaking world's records. As this is written, a woman scientist of Vienna, Mme. Anna Schiermann, claims the distinction of coming nearer than anyone else in the world to producing absolutely nothing!

In a glass bulb in her laboratory Mme. Schiermann has produced a vacuum so nearly complete, it is reported, that the amount of free gas left in it can hardly be detected. It is so small that it causes a pressure of only one fifty-billionth of a pound per square inch.

Ordinarily, in obtaining high vacuums, specially prepared carbon is used to absorb remnants of the gases not removed by powerful air pumps. In place of the carbon Mme. Schiermann substitutes tungsten filaments which, she says, have proved more efficient.

and the southern tip of Africa. Previous sounding expeditions have given geographers some idea of the location and extent of the submerged plateau, but this was the first time the new sonic depth finding devices were used for the purpose. By this method, an apparatus on the ship sends sounds down to the bottom of the ocean and the speed of the echo returned indicates the exact depth.

Although much higher than the rest of the sea bottom, the "continent" itself lies from a mile to two miles below the waves. It was probably submerged many millions of years ago.

### Silent Sounds Guide Ships

**I**NSTEAD of buying blasts from fog horns, sounds that no human ear can hear are being employed by a lighthouse at the port of Calais, France, to guide ships into the harbor in thick weather. These inaudible sounds are like ordinary sounds except that they are so shrill they cannot be heard. They can be detected, however, by electrical instruments which make them visible. They travel long

distances under the surface of the water.

At Calais, the lighthouse on shore transmits inaudible sounds in a code of dots and dashes. The signals travel under water and are picked up by amplifying devices on ships nearing the harbor. These devices are similar to those developed by the U. S. Navy and the Coast and Geodetic Survey for taking soundings at sea and for determining the distance of a survey ship from the coast.

### A Goat Serum for Measles?

**P**ROSPECTS for improved and practical methods of preventing that common bane of childhood—measles—look promising, according to Dr. Ludvig Hektoen, chairman of the medical division of the National Research Council.

A small round germ of the kind called coccus, declared Dr. Hektoen recently, has been shown by research workers to be present in our blood in the early stages of measles. The blood of goats that have been injected with these germs, he said, acquire immunizing properties that act as a preventive of the disease in humans.



# Wonders of Everyday Things

*How Insects Give Us Shellac and Ink—The Head-Hunters of Borneo—Can Rain Be Made Artificially?—More Reviews of New Books*

By THOMAS M. JOHNSON

**"Modern Aladdins and Their Magic"**

By Charles E. Rush and Amy Winslow,  
Little Brown & Co.

**"Here and There in Popular Science"**

By Jean Hous Fabre, Century Co.

**D**ID you know that the shellac on your hardwood floors was made by insects, called the lac insects probably in India? Soon after these insects hatch out, they attach themselves to twigs of trees and proceed to shellac the branches, coating them with a resinous substance which is collected and purified, to become ground.

The ink on your desk comes from insects too, and from fish. In Asia the gallfly "lays ink" on oak trees under the bark. Lumps or knots grow over the eggs, and these "nut-galls" are cut off, soaked in water mixed with green vitriol, mucilage and acid. The result is the best ink made. The ink in your fountain pen, however, is probably made from an artificial dye because it is smooth and does not thicken.

The varnish on the chair you sit on is made of sap, hardened from lying in the earth thousands of years. Perhaps it melted and flowed into the earth when the forests were burned. Thousands of people make a living digging this gum in lumps from the ground.

The chalk children use in school is made from the skeletons of sea animals that lived thousands of years ago. You can see them by looking at chalk with a powerful microscope. These tiny animalshells and their bones accumulated on the limestone sea bottom. Then earth quakes brought up the sea bottom and it dried, forming chalk pits composed of the skeletons, so small that it takes a million of them to make a cubic inch of chalk.

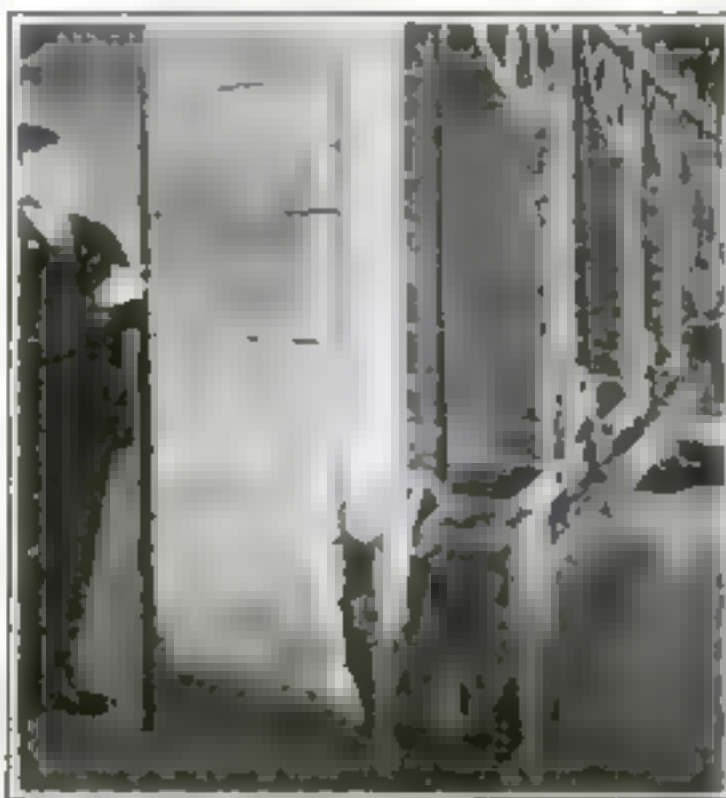
**Y**OUR aluminum kitchen utensils are made from mud. It took two hundred years to discover how to extract this light silvery metal from the earth. And the asbestos mats in your kitchen were dug up from the earth. This substance, impervious to heat, is a mineral that is mined, then winnowed and spun.

These miracles, the results of which we see before us daily, we take for granted. We meet them in our own homes, in the streets, but we pass them by without a thought. They, and many others of the wonders of everyday life about us, are told in *Modern Aladdins and Their Magic* and *Here and There in Popular Science*.

If some enterprising person, we learn, had not smuggled a machine into this country in a cargo of salt more than a

hundred years ago, we should not have the knitting industry that gives us our stockings. England was trying to keep the invention secret. The silk of which stockings are made was a secret, too, for centuries. It was long a capital crime to carry silkworm eggs out of China.

Marvelous photographs can be made



From "Modern Aladdins and Their Magic"

How matches are made. This amazing machine carries and dips one million matches at a time.

today showing the different steps in the bursting of a soap bubble shattered by a bullet. The exposure lasts 1/30000th of a second. Yet the first permanent photograph was produced only 100 years ago.

Another little known miracle of the world about us is that the plants in our gardens sleep at night, just as we do—that is, most of them do. All plants with delicate leaves sleep, and curl up at night to do it. Every plant has a characteristic attitude for nightly slumber.

**"Evenings with the Stars" and  
"The Romance of Comets"**

By Mary Proctor, Harper's

**F**LAMING crucibles of the heavens are the seven stars of the Great Dipper, most familiar of the constellations. Each of them is a mighty molten sun, probably greater than our own sun, a fiery furnace in which such stubborn metals as steel and iron are reduced to glowing vapor.

Air upon these suns is a mixture of iron and zinc steam. The clouds that form over such a world are metallic drops; its rains, molten metal.

Five stars of the seven seem to drift together, forming a sort of drifting set in the sky; the Dipper is changing, and thousands of years from now children may not be taught to look for it in the sky because it will not be there.

In fact, all things are changing continually in the sky. There are old stars and young stars, and we can tell their ages by their colors. The young star glows an ardent red. Then, as temperature increases, it becomes yellow; then white or blue. The brilliantly white or blue stars are hottest and in the prime of life. As they cool, they become yellow and finally red again, before they flicker out.

If we lived on a planet belonging to the system of Antares, our sunlight would be green or red, as our sun passed over the other. For there is a green star, a companion to Antares, whose softer light is usually obscured from the Earth by the ruddy glare of the great Antares.

The writer of *Evenings with the Stars* and *The Romance of Comets* tells these wonders of the skies on a plan somewhat new. We make the acquaintance of the stars and constellations on a series of twelve "nights with the stars." At the same time that we hear the ancient tales about them, we learn to pick them out in the sky, using a church steeple, a tree or a chimney as landmark and perhaps an opera glass as "telescope."

There really is little danger from shooting stars, we learn from the book on comets, for before they reach the Earth they burn to ashes.

**"Rain Making"**

By W. J. Humphreys, Williams & Wilkins

**W**HERE has the old-fashioned winter gone? Where are the wonderful sleighing and skating of other years?

The scientific answer is—right here, of course. The weather isn't changing, and the instruments show it isn't. There has been no persistent climatic change whatever since weather records began to be kept, Mr. Humphreys says, and he is associated with the Weather Bureau. It is we who are different, not the weather.

'Can rain be made to order?' Mr. Humphreys doesn't believe that, either. There isn't much use trying to bring on rain until Mother Nature is ready, he says. Take, for instance, the belief that thunder brings rain. Here is the truth.

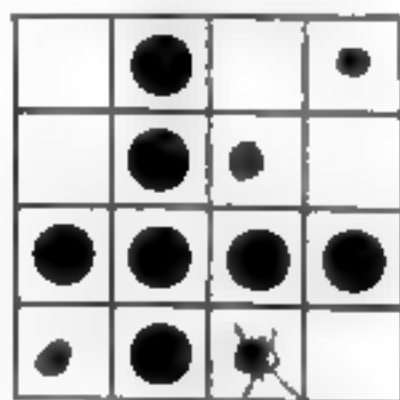
It takes electrical separation to produce a heavy peal of thunder, and for that there must be a correspondingly large amount of sus- (Continued on page 115)



# Try Your Wits *at* These Tests

*Six More Sam Loyd Puzzles to Help Measure Your Abilities Your Ratings and Solutions on Page 136*

## Does Your Memory Play Tricks?



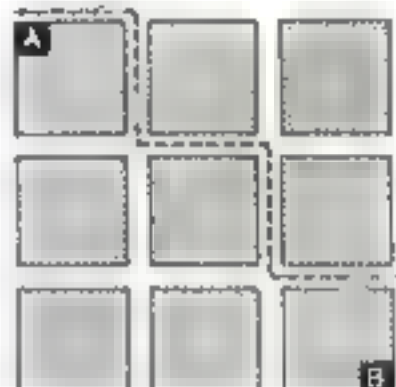
**VIEWING** these seven black checkers as rows—vertically, horizontally and on the various regular diagonals—you see that seven rows have an even number of checkers, two or four. Where would you place three additional checkers, in centers of the small squares, so as to increase to sixteen the rows having even totals?

This is a test of your memory and powers of analysis. The solution appears on page 136.

**ON THIS** diagram of nine city blocks, the dotted line represents as short a route as is possible in the middle of the road between the two points A and B. There are, however, other routes just as short. If you took that trip daily, in how many ways could you vary it without increasing its length?

Figure this out in your head, without putting pencil to paper—then turn to page 136 for your rating.

## Have You a Good Sense of Direction?



## Untying Word Knots

**A PALINDROME** is a word, phrase or sentence that reads the same backward or forward, as, for example, the Napoleonic: "Able was I ere I saw Elba." How quickly can you construct a palindrome from the following letters?

A A A A W W S S I I T T C

Your speed will determine your skill at imaginative word play—find your rating on page 136. As a tip—a feline figures in this sentence.



## Have You a Good Business Head?

**FARMER WILKINS** sold a pair of cows for \$240. On one animal he made a profit of ten percent, and on the other he lost ten percent, but on the double deal he cleaned up just five percent. What did the cows cost him, respectively?

Here's a little exercise that should show how you stand in mental arithmetic. Turn to page 136 for your rating.

## This One Takes Mental Agility



**EACH** of these five pairs of disks is to contribute a disk to fill the intervening spaces—A, B, C, D and E—and as each numbered disk is jumped to its letter it must pass over two other disks. Thus the opening jump might be 1 to B, 3 to A or D, and so on. A disk may be jumped over two single disks, too. Time yourself. Then turn to page 136.

## Have You an Eye for Line and Form?

**IF EACH** of the twelve pins forming the Greek cross above is an inch long, the space enclosed is five square inches. Your task is to rearrange those dozen pins, without measuring instruments, as a continuous fence enclosing a space of only four square inches.

Note the time it takes you—then find your rating on page 136.

## Two Magic Tricks You Can Do *By* KENNETH B. MURRAY

### The Traveling Glass

**THIS** surprising experiment consists of placing a glass of water in a hat, removing it under a handkerchief, and throwing the whole over the spectators. The glass is found to have disappeared, and then to have traveled back into the hat!

The secret lies in having the handkerchief made double, with a wire ring, the shape of the top of the glass, sewn in it. The glass is left in the hat and the handkerchief, held by the ring, lifted as if it contained the glass.



The handkerchief is sewn diagonally, so that the ring can be shifted about.



Here is the way the cigar actually looks, thrust through the hat. Upper picture. The completed effect, the other half being inside. Have a duplicate cigar handy.

### Spearing a Hat

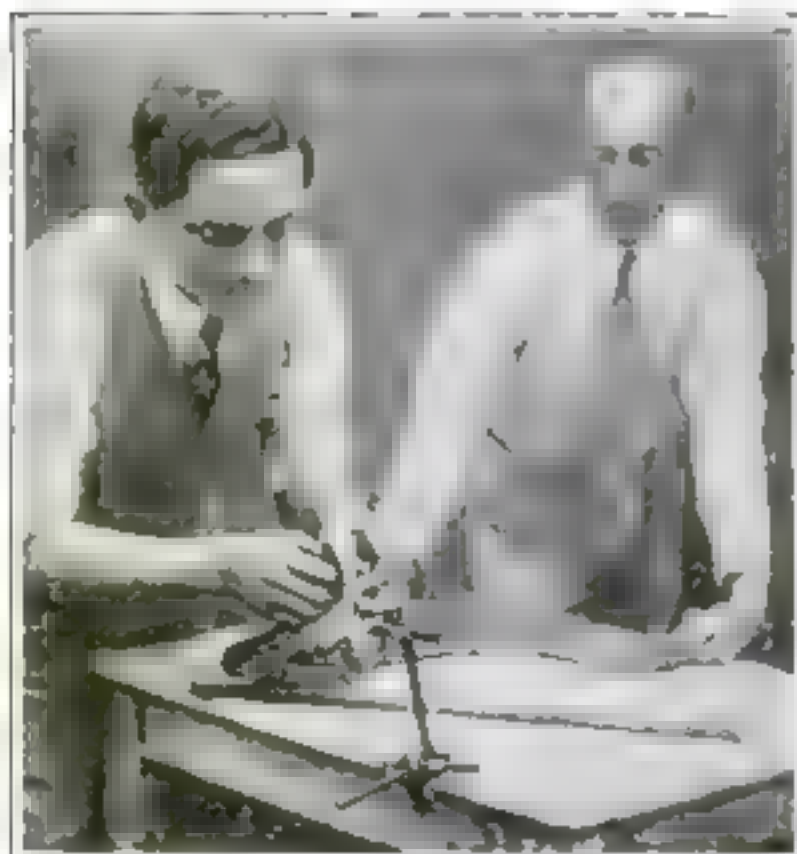
**PUSHING** a cigar through your friend's best hat always provides endless amusement—at least to the other spectators.

Cut the cigar in half beforehand, and insert a part of a needle in one half. Quickly, and concealing the cut end of the cigar during the entire performance, shove the needle into the hat with the left hand and with the right hand push the other half of the cigar, inside the hat, on the other end of the needle.



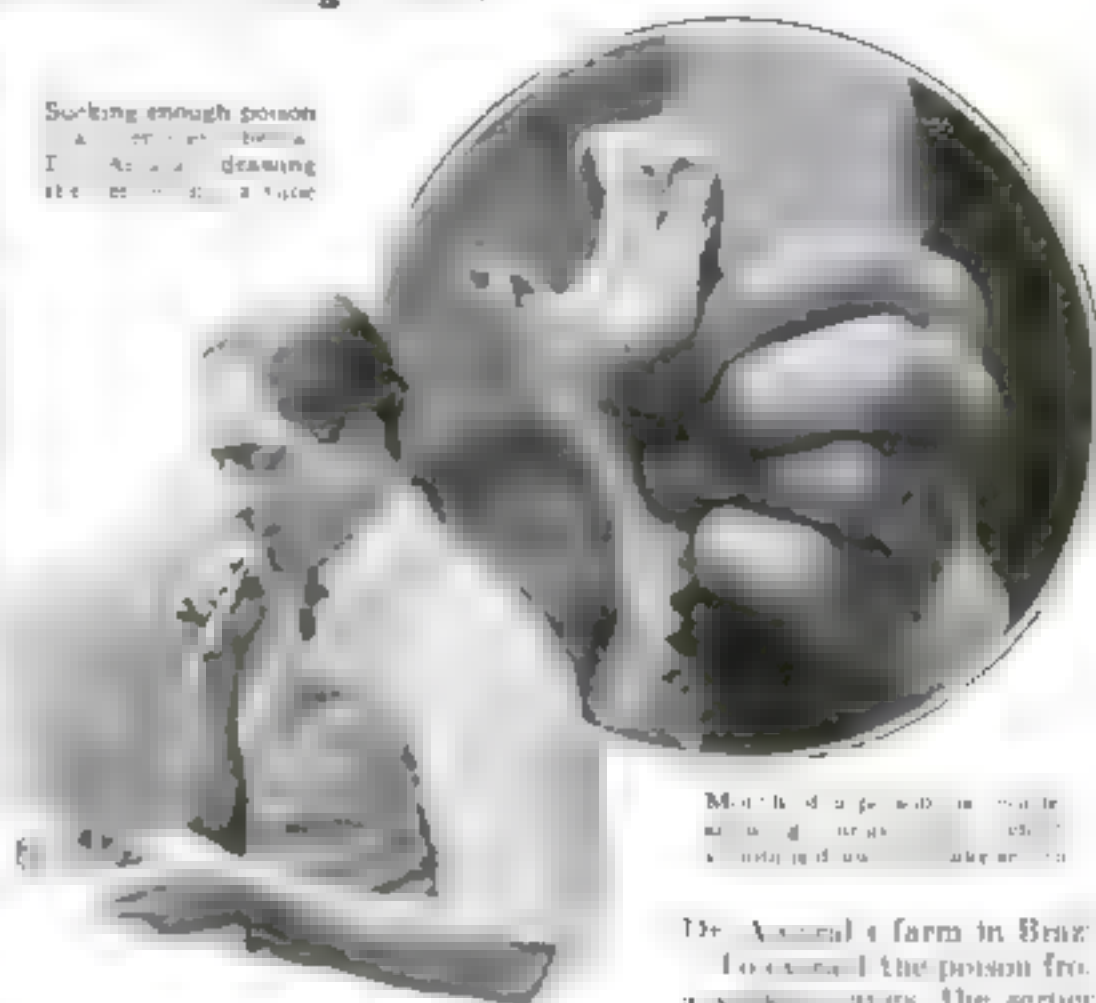
# Brazilian Helps Us Fight Snake Peril

*Bite Serum Soon to Be Sold in Drug Stores*



Dr. Amarel, the world famous snake expert, extracting the "Milk" from a snake at the New York Zoological Park. For the purpose of extracting the "Milk" from a snake.

Sucking enough poison  
A certain time  
I. As a drawing  
the snake is a type



Milk of a snake is made  
the snake is a type  
the snake is a type

**V**ENOMOUS snakes are made to yield their poison, and for the first time a famous snake bite serum is being produced in the United States, at the New York Zoological Park.

A few months ago Raymond L. Ditmars, curator of reptiles at the zoo, visited the largest snake farm in the world, at Sao Paulo, Brazil, to study methods of extracting the venom of poisonous serpents and making it into antitoxin. There, under the guidance of Dr. Afranio de Amarel, head of the farm

and world's foremost snake expert, Mr. Ditmars observed how reptiles were handled to obtain the deadly fluid. On his return, he commenced the work of producing the serum in this country, and Dr. Amarel, paying a return visit, has been collaborating with him.

Snake serum standardized and distributed so that it can be purchased by anyone over the counter of any drug store, has long been a need in the United States. Up to now our supply of the life-saving antitoxin has come from

abroad. To extract the poison from a snake, the serpent is pinned down with a long stick and grasped behind the head. The deadly jaws kept out of harm's way. Held over a container covered with cheesecloth, the enraged snake bites the rag and releases a flow of venom heightened by hand pressure on the poison sac in its head. Small quantities of the poison are diluted and injected into horses, which gradually acquire immunity to it. From the horses' blood the serum is made.

The only certain cure in case of snake bite, says Dr. Amarel, is prompt application of this snake bite serum.

## Government Fabric Tests Tell Us How to Buy Clothes

**W**HAT makes some winter coats warmer than others?

The Bureau of Standards has just completed a series of experiments to answer this question. The results have upset some of our pet notions about the warmth of the goods from which our suits and overcoats are made.

They show, for one thing, that a coat made of cotton can be just as warm as a wool one. It is not the kind of fabric that makes the difference in warmth, but the way the fabric is woven.

In the experiments, the fabrics were put through three different tests, measuring their ability to resist wind and air heat, and moisture. In every case it was found that resistance depended not on the

kind of fabric, but on the closeness of the weave.

Finally, the tests so far have led to the conclusion that fabrics of moderate

density are more effective in retaining heat when not exposed to wind, while the denser, heavyweight fabrics are better for keeping out the wind.

The heat retention tests are made with a square metal plate, electrically heated. Samples of the fabric are clamped down on both sides of the plate so that no heat can escape except through the fabric. The escaping heat is then measured electrically.

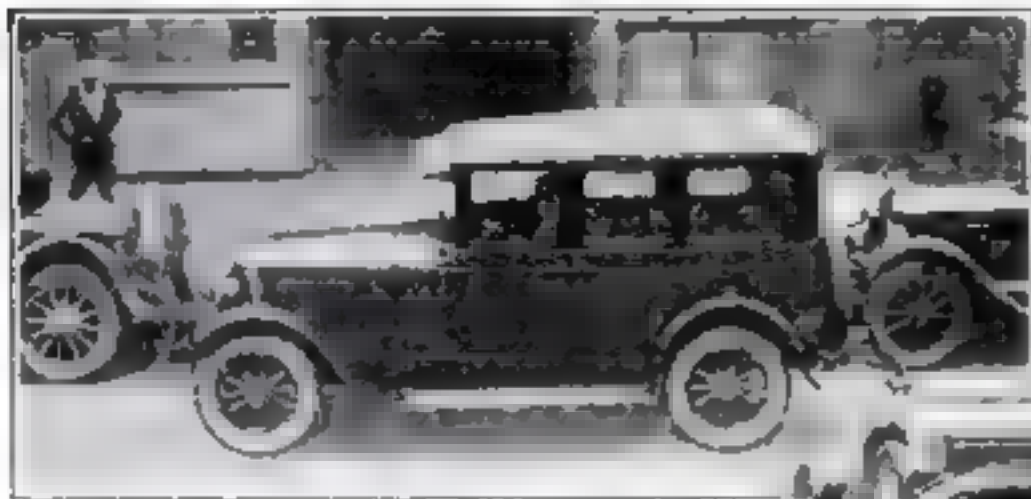
To study the problems of textile manufacture, the bureau has constructed the laboratory-size textile plant pictured here. Air conditioning apparatus, a part of which is seen at the ceiling, permits regulation of temperature and humidity to obtain any desired working conditions.



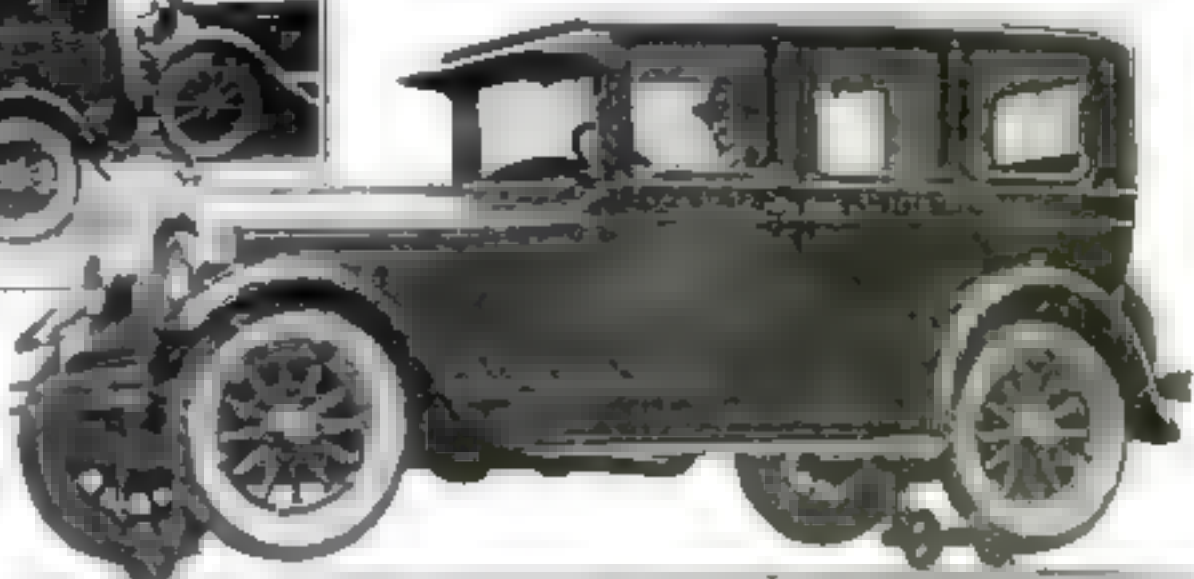
Experimental "textile mill" where Government experts are testing the fabrics our clothes are made of. Varying "weather conditions" are produced here.



# You May Drive Your Next Car Sideways



Above: Moving sideways to the curb between two cars and not touching either. Right: Car raised off the ground for the sideward move

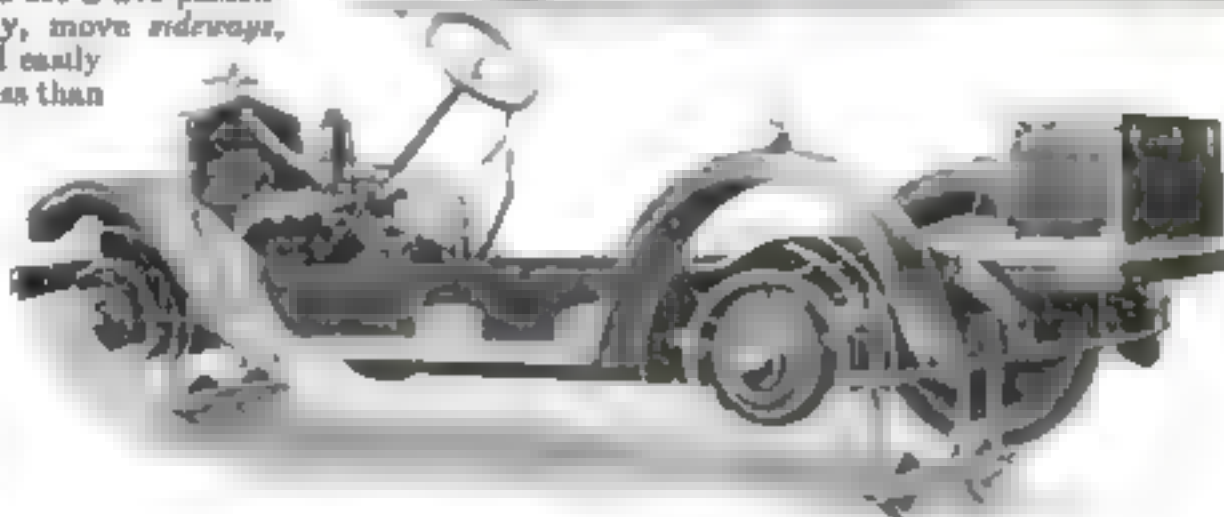


**O**N A crowded street in Baltimore, Md., the other day, passers-by were amazed to see a five-passenger car stop suddenly, move sideways, and slip smoothly and easily into a parking space less than two inches longer than the car itself!

With the halting of his car the driver had thrown out his clutch and moved a small gear lever. His engine kept on working. With the shift, the automobile began rising from the pavement. Within a few seconds the wheels were a full three inches from the ground.

Then the driver shifted the lever once more and the vehicle began to move sideways toward the curb between two other cars. Immediately against the curbstone but without touching, the driver, pressing on the clutch pedal, brought the sidewise journey to an end.

This remarkable feat was accomplished through the use of an ingenious new parking device, the invention of Villor P. Williams, a Baltimore engineer. The device carries four small, solid-tired wheels, concealed beneath the chassis of the car close to the vertical plane of



Left: How the four auxiliary wheels are attached and controlled by special levers. Note their position at right angles to the main wheels of the auto

each axle. They are set at right angles with the frame.

These small wheels are made to descend through the use of a worm gear connected with the transmission, and operated by the engine of the car. When the small wheels touch the pavement, the worm gear continues to work, exerting powerful downward pressure, with the result of lifting the car bodily.

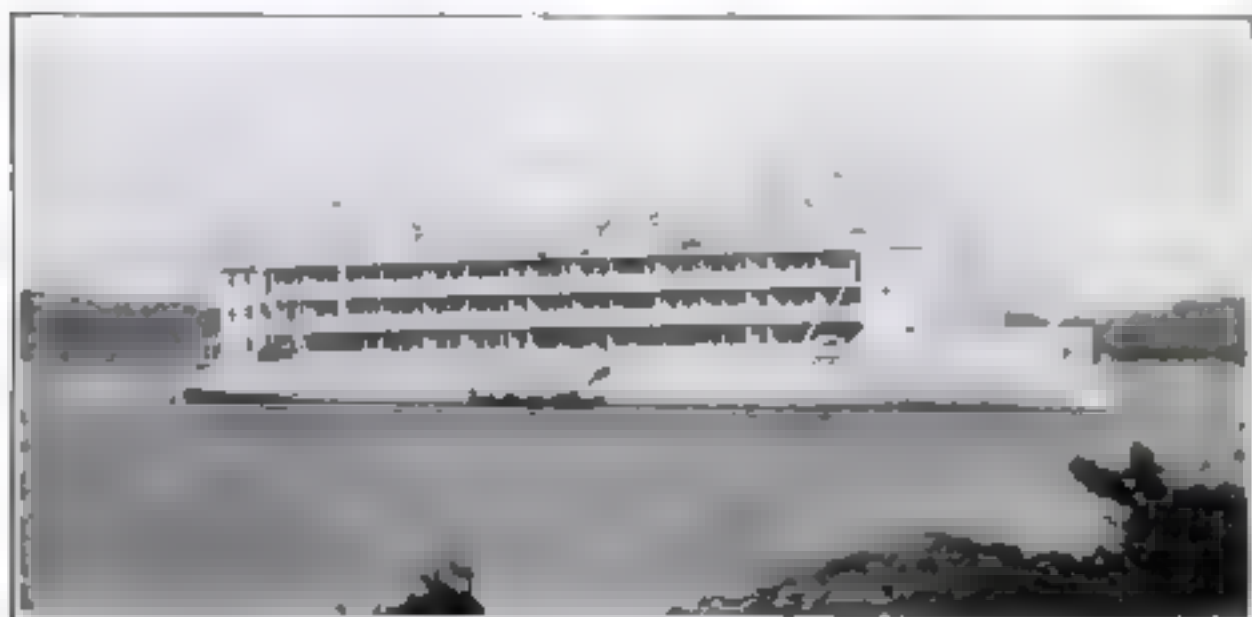
When the 3800 pound weight is supported by the auxiliary wheels, a shift of the special gear lever operates a mechanism which causes the car to move sideways on the small wheels. This, too, is

accomplished by means of the car's motive power, and without the driver's having to leave his seat. The sideward motion may be continued indef-

initely across the street or for the full length of a boulevard.

After being halted, the car may be lowered again or it may be left in the air. Removal of the vehicle from the restricted parking space is merely a matter of reversing the process.

Other advantages of the device, besides its application to parking, are pointed out by the inventor. Because it enables the driver, in his seat, to lift the car clear of the ground, it goes away with the hand jack in changing tires. Similarly, the added clearance simplifies the task of making repairs underneath the car.



Once an ocean fighter for Uncle Sam, now fulfilling the more peaceful purpose of ocean hotel for pleasure-bent vacationists—the former U. S. S. *Amphitrite*, anchored off Beaufort, S. C.

## Old U. S. Monitor Now a Floating Hotel

**H**ONORABLY retired from the Navy the U. S. S. *Amphitrite*, a war vessel of the monitor type, has been converted into a palatial and luxuriously equipped hotel. The large rooms within are in striking contrast to the usual small cabins.

Its dazzling whiteness and fluttering flags make the former monitor a picturesque sight off Beaufort, S. C., where it is anchored for the winter. Next summer it will journey to Long Island Sound. The made-over ship has a length of 265 feet, and is fifty-five feet wide. Its shallow draft enables it to be anchored near land, and small boats are used to ferry the hotel guests to and from shore.



## Novel Fire Escape Formed by Cable and Belt



Sliding down the new "fire escape." He controls the speed by means of a thumbcrew.

### World's Largest Transformers

**B**IGGEST of their kind in the world, four gigantic single-phase transformers have been built by the General Electric Company for the Pennsylvania Power and Light Company. In the photograph at the right are seen the coil and core of one of these mighty units. They have an overall height of nearly twenty-four feet, a length of eight feet and a width of about twelve feet.

Four of the units were constructed, three to be used in one bank and the fourth for a spare. The total weight of each is 202,200 pounds, of which the oil weighs 70,000 pounds. Each has windings for 11,000 volts.

Standing in front of the transformer are left to right: W. S. Moody, engineer, G. Paccioti, engineer, and C. C. Chesney, manager, all of the General Electric's Pittsfield Works.

**D**OWN a steel wire to safety, supported in a safety belt, slides the user of this latest type of fire escape, produced in England.

Trapped in a burning building, if you're lucky enough to have this outfit on hand, you quickly attach the long wire cable to the window sill or any other support, drop the wire out of the window, and adjust the screw that fastens the belt to the wire. Then you slip into the belt and slide down.

The supporting belt is hung on the wire by means of a wooden block having a zigzag slot cut in it for the cable to pass through. The speed of descent is controlled by a thumbcrew in the block which provides tension on the wire.

It is a device which should be kept handy, the inventor thinks, in every high building, even where there are the usual fire escapes, for these are frequently blocked off.



A notable engineering feat: coil and core of the world's biggest single-phase transformer



### This Cotter Pin Won't Slip

**O**IL and grease on the machinist's hands make it a tricky job for him to fasten a cotter pin without slipping. The roughened surface of the improved cotter pin in the picture above provides a good hold, giving him a pin easier to grasp in the jaws of his pliers.

### Versatile Clock Runs the House

**W**ITH almost human intelligence, a recently invented clock assumes the usual duties of a responsible housekeeper. At any time desired, the timepiece turns the lights in the house on or off. Besides showing the time of day, it has two additional hands to indicate the day and the month.

Outwardly resembling an ordinary clock, the new device contains a built-in electric motor that takes its supply from the house current. Accidentally deprived of this power source, it will still run for four days without winding, it is said, and will "pick up" the lost windings when the current is again turned on. Its inventor is Dr. J. F. Van Slyke of the Horological Institute of America.

### Locomotives Get Speedometers

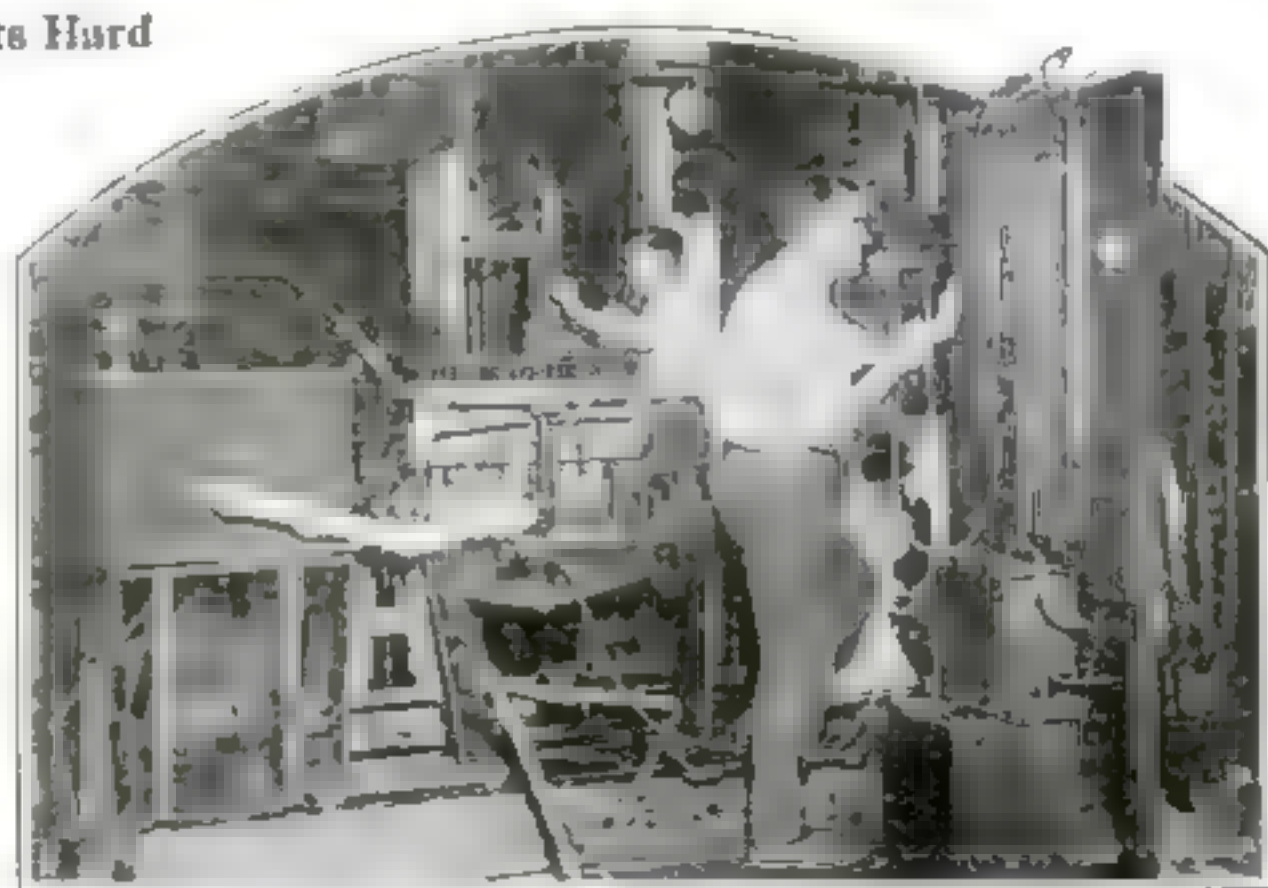
**A**T LAST locomotives have been fitted with speedometers, the swaying and vibration of the train having long hindered the accomplishment of this feat. Electrically operated, the new device employs a magneto run by the engine wheel. An indicator, calibrated in miles per hour instead of volts or amperes, is mounted in the cab.

## Why Your Auto Engine Starts Hard

**M**OTORISTS everywhere will follow with interest the experiments now being made by Bureau of Standards experts John O. Eisinger and Stephen A. Buckingham, to find why an automobile motor starts hard in wintertime.

To simulate actual winter conditions for these tests, brine at freezing temperature is circulated through the water jacket of the motor and even the air supply to the carburetor is refrigerated. A careful check is kept on all operating conditions; various temperatures are tested with all kinds of gasoline as well as different motor compression ratios and self-starter motor speeds, and the results noted.

It is expected that the results of the thousands of experiments will help both the automobile manufacturers and the oil industry to overcome winter hard starting troubles. Already, says Mr. Eisinger, there is a tendency on the part of oil companies to improve gasolines in regard to their starting characteristics.



Testing engine and fuels at the Bureau of Standards to solve starting troubles





### It's Wrench and Hammer in One

**A**N ALL-PURPOSE tool combining several useful features is this odd-looking combination hammer and wrench. Its versatile jaws drive a nail or twist a pipe with equal ease. A right-angled claw removes nails even in cramped quarters. Round surfaces are firmly gripped with the Stillson-type jaw.

### Soap Mining a New Industry

**N**EAR Death Valley, in California, there exists the unique paradox of a soap mine, which has recently given rise to the strange new industry of mining soap. From this mine is dug amargosite, a soft smooth rock, rather sticky. A lump of the mineral breaks up when shaken with water making a soapy liquid having excellent cleansing properties.

Observing the Indians using it, R. K. Fairbanks, a pioneer settler of the Shoshone country, succeeded in finding out where it was obtained.



### It Massages While You Swing

**T**WO body-strengthening features are incorporated in the new massage exerciser above, the invention of Alvin Kost, of Portland, Ore. While the reducing rollers on the massage cradle (inset, above) are getting in their work on chest or abdomen, the muscles of the arms, hips and chest are being exercised on the hand bar. The user swings from the hand bar while his chest, back, waist or hips rest against the massaging cradle. This in turn follows the movements of the body.

## Eight Minutes for Your Photo by Slot Machine!

**Y**OU step into what looks like an elongated telephone booth, seat yourself, assume your best smile, and drop a coin in a slot. There is a whirring sound, powerful lights flash on, a shutter clicks. You step out of the booth and a few minutes later a finished strip of eight photographs of you is delivered at the other side of the machine.

Such is the new self-service photographic machine, called photomaton, invented by Anatol M. Josepho, of New York City.

What happens within the machine is this: The dropping coin closes a switch that starts an electric motor. Four 400-watt electric daylight bulbs are turned on. A strip of sensitized paper is fed into the camera by an ingenious roller that gives it a skip-stop motion, hitching it along with intermittent pauses. Synchronized with these pauses, the camera shutter opens and closes eight times, remaining open each time for one-fiftieth of a second. Leaving the camera, the picture strip enters the developing solutions—



Cutaway model of the photomaton, or self-service photographic machine. Its inventor, left, is pointing out the enclosed switch-board panel; the man at the right is examining the finished strips of pictures, and the girl in the booth is ready for her picture. In upper right of the booth is the reel of sensitized paper.

first the developer, then a bleaching solution, a clearing solution, and lastly the toner that gives the pictures their sepia color. Finally the pictures are squeezed to remove excess moisture, carried on a chain through an electric hot air dryer, and delivered as finished photographs. The entire process requires eight minutes. Enlargements can readily be made from the small photographs.

### Mechanical Driver Tests Balls

**A**BOUT the only way to find out if a golf ball was good, prior to the invention of the testing device below, was to play golf with it.

This device consists of a swinging club which operates automatically, hitting the ball with predetermined force. The person conducting the tests simply pulls a cord, thereby releasing weights which cause the club to hit the ball with a standard force. The illustration shows the position of the mechanical driver after hitting the ball.

Since the force of the drive can be

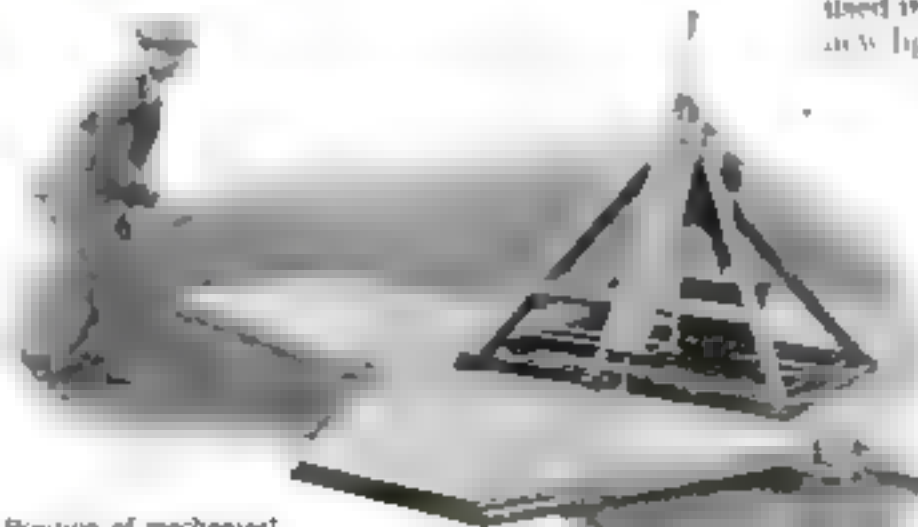
predetermined and measured exactly, the operation is said to furnish an accurate test of a ball's balance, resilience and toughness.

### Aluminum Trolley Car Arrives

**T**HERE is one city in the United States, at least, where street railway officials will not admit that the street car is becoming a back number. That city is Cleveland, Ohio.

The Cleveland Street Railways have developed a new type of car which, by increased economy and efficiency, is expected to give buses and taxicabs a run for their money. The materials used in its construction are the new light-weight aluminum alloys developed for aircraft.

The new car is nearly one fourth lighter than a steel car. As a result, less power is required to run it, and it can be started and stopped more easily and quickly. This means marked reduction in operating costs, part of which are due to the frequent stops.



Position of mechanical driver after hitting the ball.



## Astronomers Check Up on Continental Drift



Part of world-wide radio net testing continental drift

**A**RE North and South America drifting further and further upon the bottom of the ocean? That is what astronomers suspect, and propose to find out, with the aid of such instruments as that illustrated at the left. Longitudes are checked with incredible exactness by this instrument, which compares local astronomical time with standard time signals received by radio, as part of a series of tests at San Diego in conjunction with stations at Algiers and Shanghai. Startling disclosures may result from these experiments, though the experiments may have to be repeated for several years, for checking-up purposes, before definite conclusions from the observations can be drawn. Seated at the delicate precision instrument is J. C. Hammond,

astronomer of the U. S. Naval Observatory, Washington, D. C. At the left is Dr. Frank B. Littell, professor of mathematics at the observatory.

## Paper Money from Tobacco Waste

**D**URABLE paper currency can be made from the waste cuttings and stems of tobacco, it is reported from Europe. The waste from tobacco factories is first treated by a chemical process to render it tough and pliable. It is then run through special machinery to cut it fine and is used as a substitute for the more costly waste linen rags.

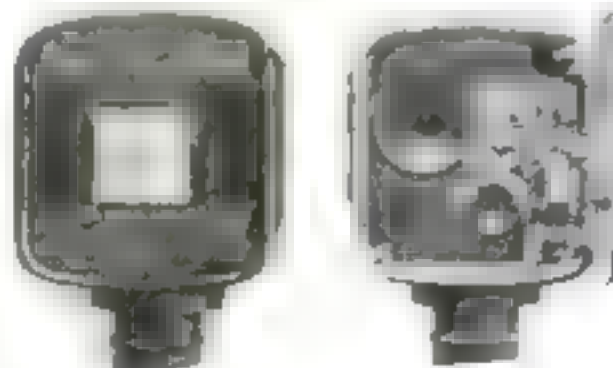
## How Much Do You Know of the World You Live In?

**T**EST yourself with the following twelve questions, selected from hundreds of queries sent in by readers of POPULAR SCIENCE MONTHLY. The correct answers appear on page 142.

1. Where are the oldest trees in the world?
2. What is the usual path of storms across the United States?
3. Why do the Eskimos eat so much fat?
4. What ancient American people made human sacrifices?
5. Why might a dike between Florida and Cuba spoil the climate of England?
6. Where do ants raise mushrooms for their food?
7. Which is the greatest museum in the world?
8. Why are negroes sometimes called "Senegambians"?
9. Who built the first ships?
10. What are staircase farms?
11. What plant has the largest leaves?
12. What islands have the most unique vegetation?

## New Loudspeaker Fire Alarm

**I**N USING a new fire alarm recently installed in Birmingham, England, instead of pulling down a hook you speak

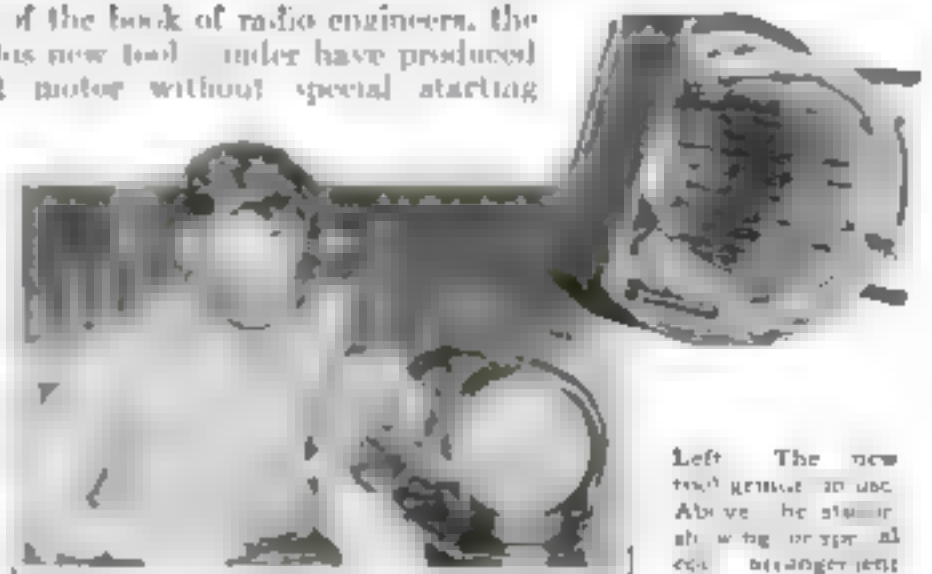


Left: New fire alarm closed. Right showing the loudspeaker horn in the cab box

into a microphone connected to a loudspeaker in the fire station. Opening the fire box door automatically switches on the telephoning current. Through another loudspeaker in the box itself comes the amplified voice of the fire chief, asking where the fire is and telling you what to do until the engines arrive.

## Tool Grinder Uses New, Simplified Motor

**T**AKING a leaf out of the book of radio engineers, the manufacturers of this new tool grinder have produced an alternating current motor without special starting winding commutators or automatic switches. A condenser that is charged from the power line discharges the one coil in the motor. This is followed by the current directly from the line through the main coil, which draws the charged part of the rotor toward it.



Left: The new tool grinder in use. Above: the stator showing original design



## Magnifying Lorgnette Saves Eyes

**T**O ELIMINATE one-eyed squinting through a magnifier to discern minute lettering on maps and drawings, army engineers have adopted these novel binocular "lorgnettes." When held before the eyes, they make the smallest details of aerial maps and photographs plainly visible.

Now the interesting possibility has been suggested of making stereoscopic relief maps that, when viewed through these glasses, will make high mountains stand out and valleys appear as sunken depressions.

In the photograph, Lieutenant J. M. Young of the Engineer Corps is seen using the new aid to the eyes.

## Invents Silent Railway Car

**T**HE problem of engine vibration, it is reported, has been met and conquered by a Swedish railroad engineer, Magnus Tacklind, of Stockholm. He has designed a railway motor car said to attain a speed of fifty miles an hour with no more noise than the clicking of the rails.

The silent car has an underslung motor, entirely separate from the frame of the car. Power is supplied to the drive wheels from the motor by five distinct sets of gears, all in simultaneous use.

## Colored Movies Show Operations

**M**OTION pictures of surgical operations in natural colors have been obtained in Berlin, Germany. A three color process is used. Reflectors concentrate powerful light on the operating table. The camera is self-cranking, the electric motor drive being controlled by an operator who watches the progress of the operation through a telescope.



## Cardboard Doll Tests Machine Designs

**S**PECIAL machinery for use in the manufacture of telephones by a great Eastern company is now being tested, when still in the design stage, by cardboard dolls.

A cardboard doll with movable arms, legs and head, correctly jointed, has been carefully drawn to scale. It is made one fourth the size of the average man, as this is the scale to which most machine drawings are made.

In machine design, it is important to insure that the parts of the machine be convenient and accessible; to have the levers within easy reach, for instance, and sufficient head clearance. The manikin, placed upon the machine drawing shows instantly how well a real operator can run the machine. By any other method the design may be checked up only by actual operation or by tedious, time-wasting measurement.



Courtesy Modern Electric News

Testing a machine design with the cardboard doll

The joints of the body have been scientifically located, for the figure must be made to bend forward and backward just as the real operator would do.

## Butter Churned While You Wait

**V**ARYING the time-honored method of turning cream into butter, a French inventor has devised a new machine to accomplish the same result mechanically.

In the device illustrated above, double pistons operated by the hand crank churn the mixture in the central chamber. A suction tube draws sour milk from a pail at the right, the flow of milk being regulated by a valve at the end of the intake tube. During the churning in the middle cylinder, butter is ejected as fast as it is formed, and is forced out through the small tube at the front of the machine into the pail on the left.

From 100 to 150 quarts of cream can be converted into butter with this device daily, according to the inventor. An electric motor can be attached to the machine, if desired, to eliminate the monotonous hand cranking.



The shaving mirror with built-in light; the bulb is behind the mirror light being thrown up by curved white reflector

## Shaving Mirror Has Own Light

**F**OR the man accustomed but not resigned to shaving in poor light, the shaving mirror at the left offers the pleasant novelty of "a light that shows up every hair on the face." Light from a lamp concealed behind the mirror is reflected upward on the face, the lamp being thus safely shielded from the eyes.

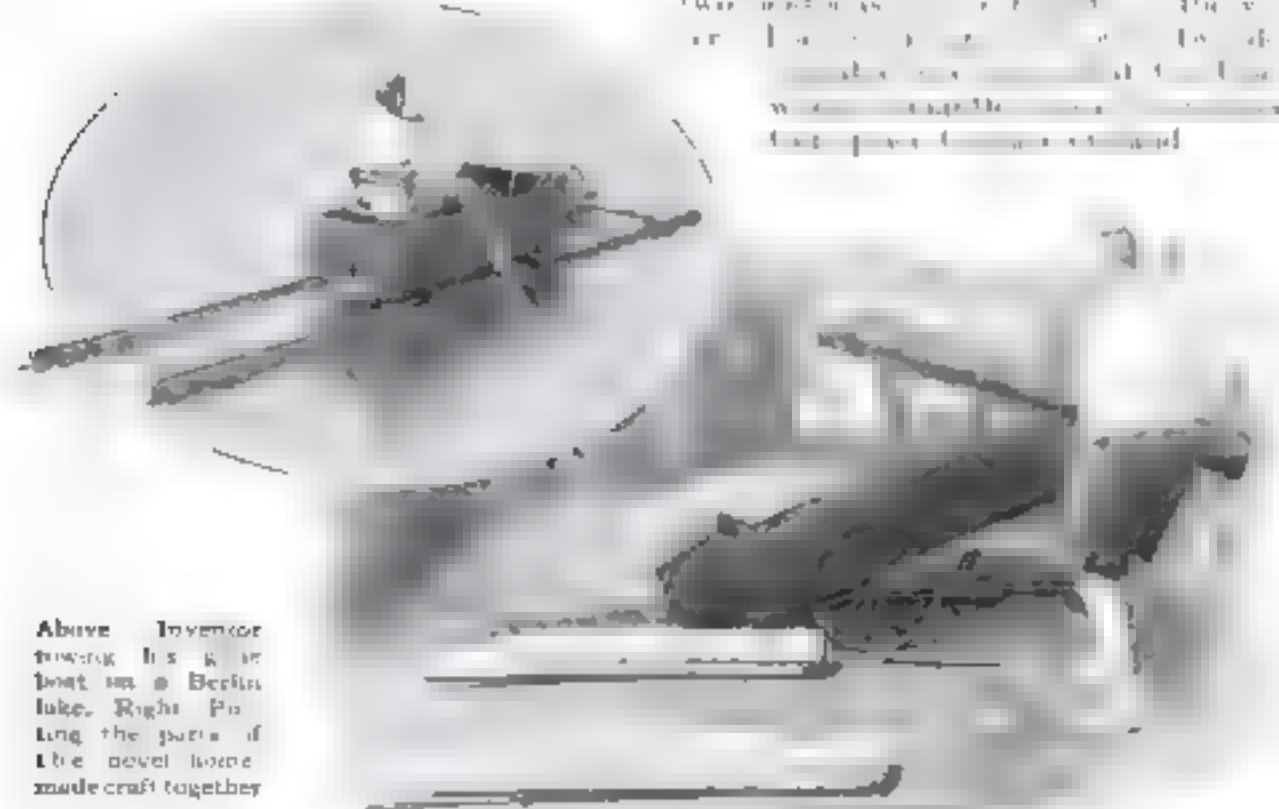
## Homemade Boat Glides on Stovepipe Pontoons

**C**APABLE of being put together or disassembled in a few minutes, the odd-looking "glide boat" illustrated below is a new product of German invention.

The craft is entirely homemade, even to the two pontoons, fashioned out of

stovepipe, that buoy it up. Ingeniously constructed out of odds and ends, it opens a new water sport to the possessor of the queer aquatic vehicle, who sits within a wooden box in the center and paddles himself about the lake or stream.

Five crosspieces, fastened across the two pontoons, support the box. The vessel is propelled by a single oar, which is attached to the box by a long handle. The entire craft is made of wood, and is painted to resemble a boat.



Above: Inventor towing his "glide boat" on a Berlin lake. Right: Putting the parts of the novel homemade craft together

## KNOW YOUR CAR

**T**HE wear on the average motor car is far more severe in winter than in summer, despite the fact that the car usually is run comparatively little in cold weather.

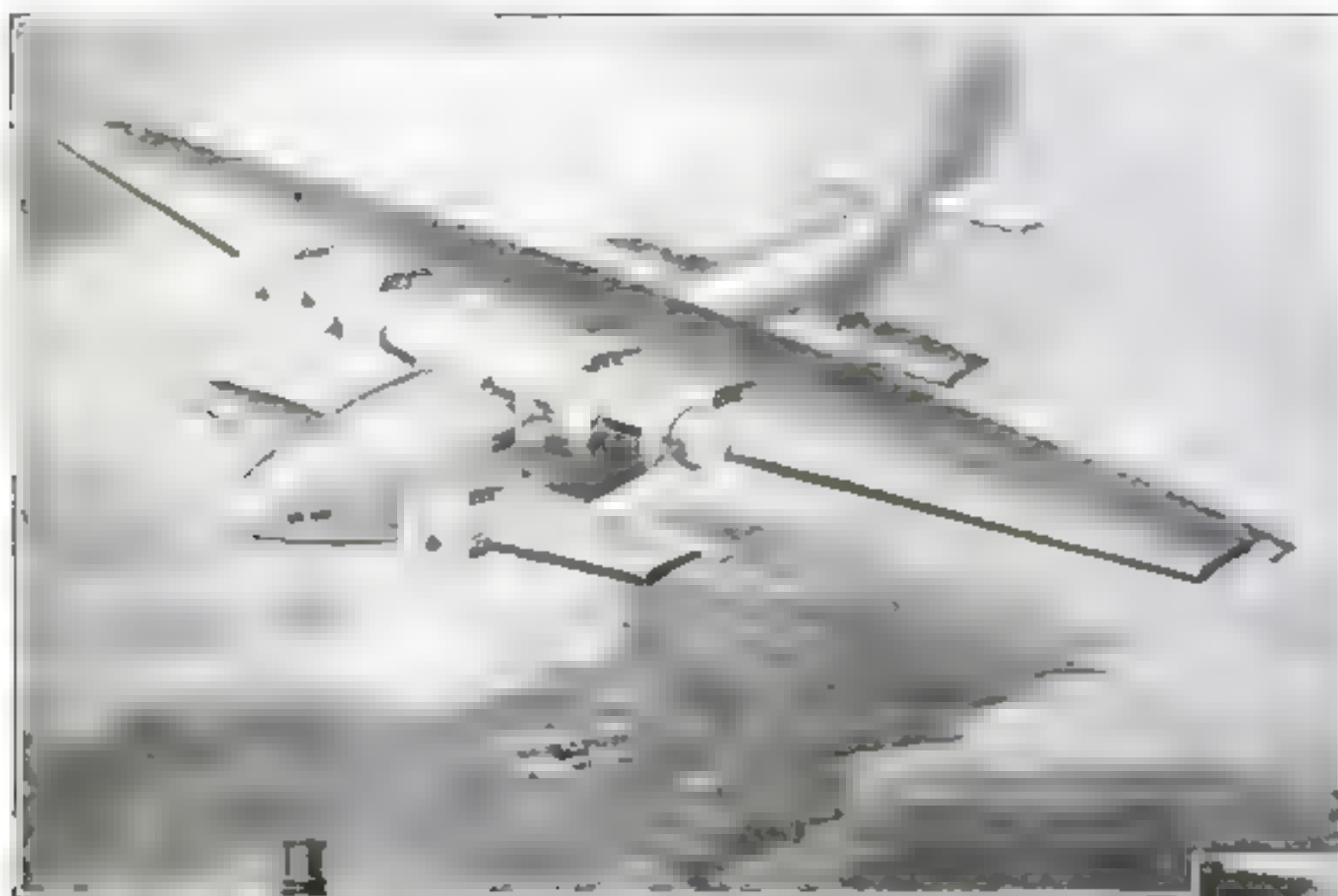
There are two main causes for this. One is that the choke must be used for several minutes in starting up because the motor is so cold, resulting in excessive crank case dilution and consequent poor lubrication. The other is that many owners do not cover up a portion of their radiators so the motor will warm up to normal summer temperatures. This also results in condensation of liquid gasoline on the cylinder walls, and so dilution of crank case oil, goes on all the time the motor is in use. Carbon also forms rapidly in a motor run too cold.

Follow these rules during cold weather:

1. Use the choke as little as possible.
2. Let the motor idle slowly with the radiator covered up until it attains proper temperature.
3. Never race the motor idle or drive fast until the motor has had time to warm up.
4. Keep enough of the radiator surface covered up so that the thermometer will register summer running temperature.



# Aviation's Advances *at* Home



## Strange Air Liner For Ocean Hops

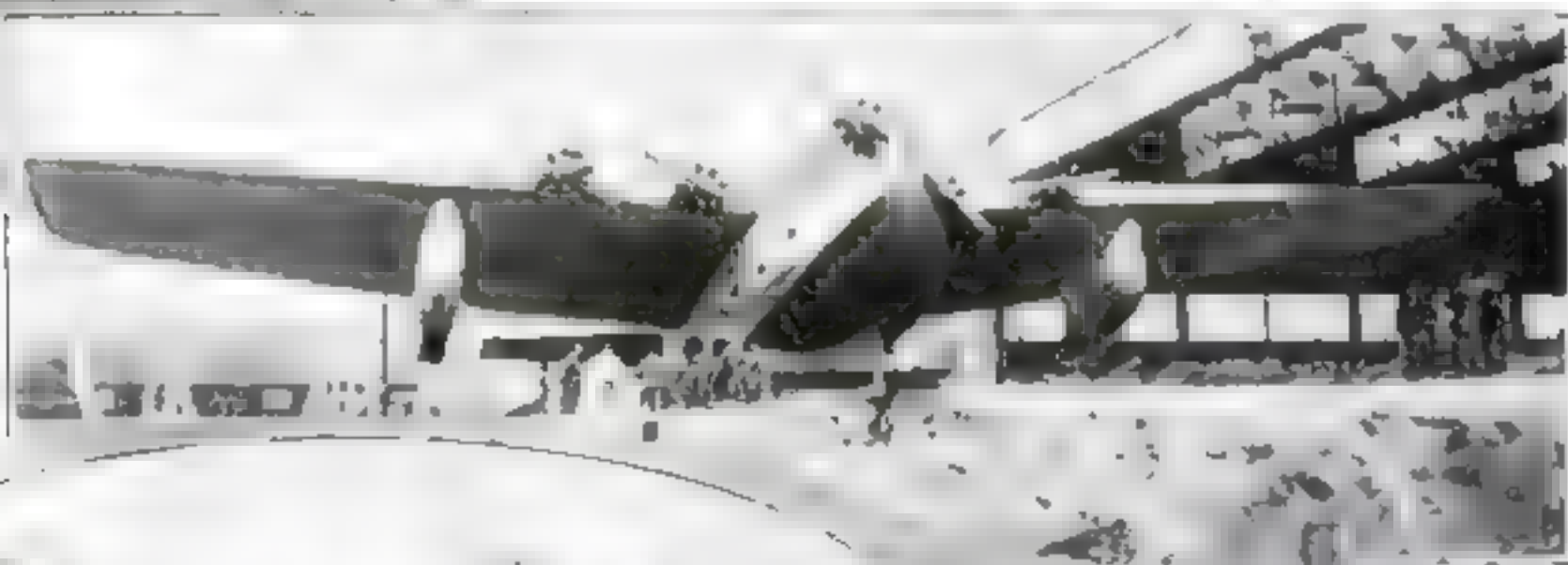
WHEN it is possible to fly across the Atlantic in a single day, it will be a great step forward in aviation. The new airplane, the *Stratoliner*, is being designed to make such a journey. It is a four-engine plane, with a wingspan of 150 feet. It is designed to fly at a speed of 150 miles per hour. It is being built by the *Stratoliner* Corporation, of New York City.

## Mobile Lights Aid Night Landings

A new device, known as the *Mobile Light*, is being used to aid night landings. It is a small, portable light, which can be moved about the runway. It is being used by the *Mobile Light* Corporation, of New York City.

## Absorbs the Shock

Rubber shock absorbers are being used in the new airplane. They are made of a special rubber, which is designed to absorb the shock of landing. They are being used by the *Rubber Shock Absorber* Corporation, of New York City.



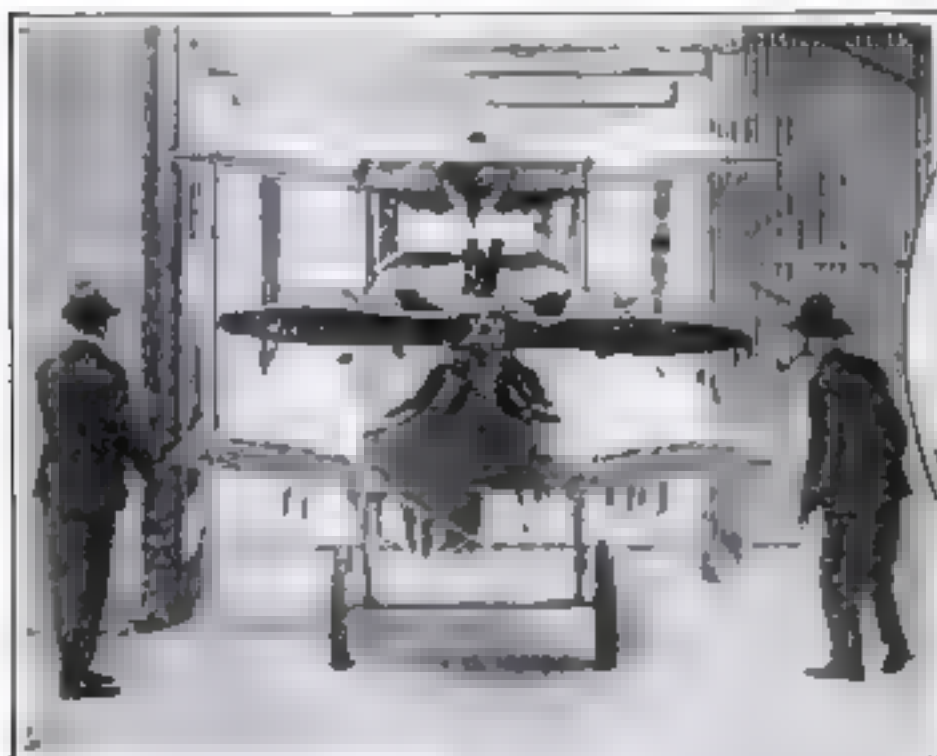
## Giant Flying Boat Has Five Motors

Completion of the monster seaplane here pictured is the largest in the world. The *Giant* is a five-engine plane, with a wingspan of 200 feet. It is being built by the *Giant* Corporation, of New York City. It is designed to fly at a speed of 150 miles per hour. It is being built by the *Giant* Corporation, of New York City.



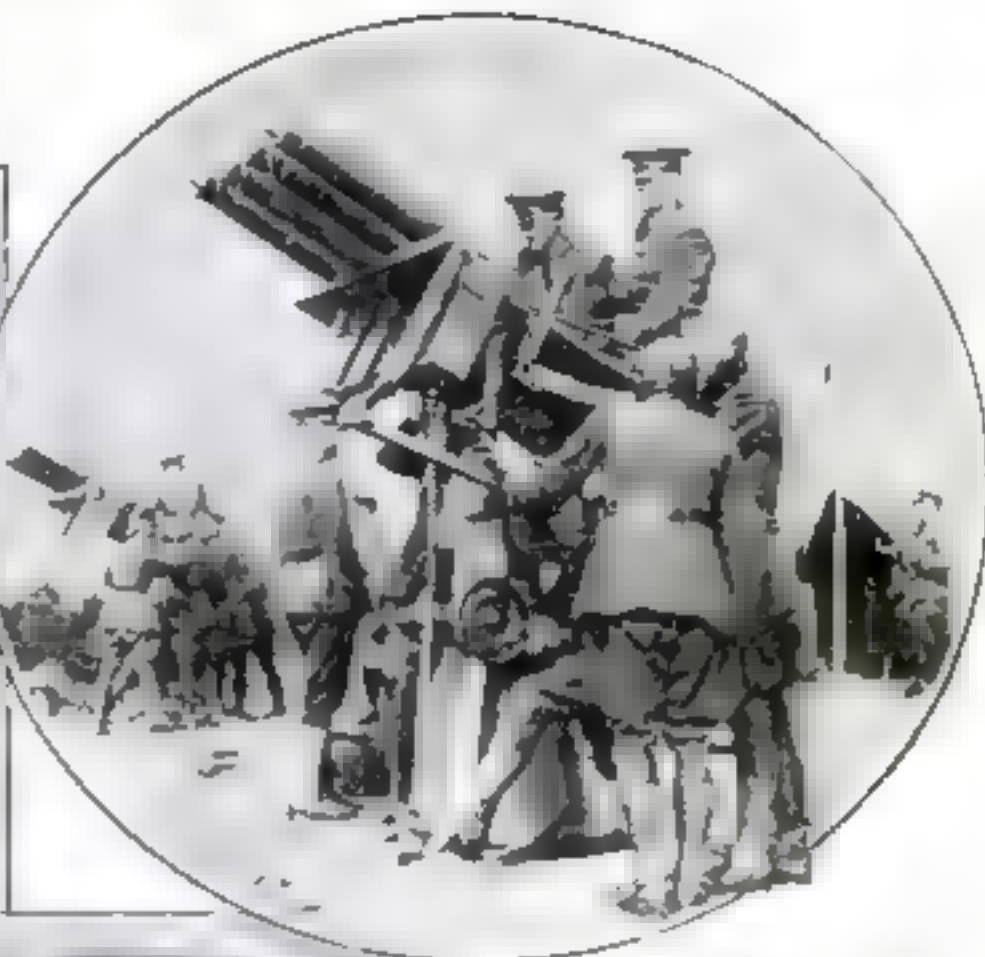


# and Abroad



## Fits into a Garage

A new British type of folding airplane is being built in London. The airplane is small and can be folded into a compact size for storage in a garage and is being built in an ordinary sized garage.



## Shoots Four at Once

The new gun is being built in London. It is a small and can be folded into a compact size for storage in a garage and is being built in an ordinary sized garage.

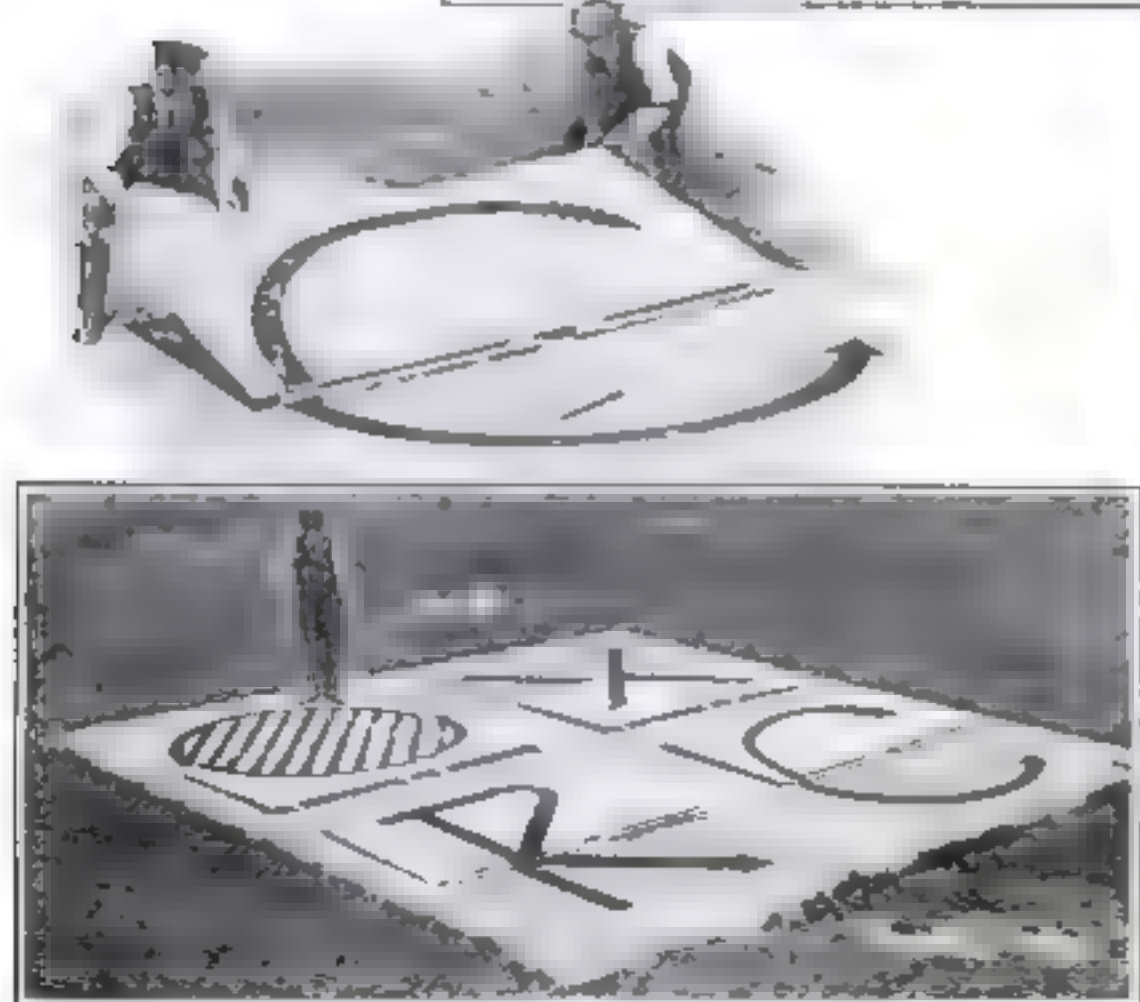
## Ocular Weather Signals

When the sun is visible in the sky, it is a sign of good weather. When the sun is not visible, it is a sign of bad weather. The sun is visible in the sky when the weather is good. The sun is not visible in the sky when the weather is bad.



## A Tricky Jump

The new gun is being built in London. It is a small and can be folded into a compact size for storage in a garage and is being built in an ordinary sized garage.



## Future Queen of the Air Lines

Workers are assembling the plane which will be the world's largest passenger-carrying airplane. It will be sixty-five feet long.

## Miners Now Wash Gold from Sand by Machine



Modern miner's "gold pan," with its inventor, J. H. Ratcliffe, at right

### Could Crush Mightiest Girders

**SO POWERFUL** that it can crumple a huge steel I-beam as if it were made of cardboard, this Hercules of machines, at the right, the largest testing machine in the world, can exert a crushing force of 10,000,000 pounds! No conceivable stress to which a girder might ever be subjected could even approximate this force. The machine is used at the Bureau of Standards, Washington, D. C., for testing structural members, with the object of determining how much weight they can withstand without buckling. The results of the tests become a part of engineers' books of tables, to be used in designing towering structures of steel.

found. Mechanical agitation is provided. The photo shows the inventor, J. H. Ratcliffe, California mining engineer, demonstrating his remarkable device.



It's the biggest testing machine in the world



They pull up snugly over silk stockings

### Rubber Spats the Latest

**FLAPPING** galoshes are no longer the swagger thing in feminine winter footgear. Rubber spats that pull over the stockings, covering the whole leg, are a new offering of a thoughtful inventor. They button snugly

**LIKE** the old miner's gold pan, which washed gold from sand and rock, is the concentrating and amalgamating machine pictured at the left—except that it's entirely automatic and adapted to the high-speed requirements of modern mining methods.

Water flowing down the sloping platform separates the gold from the sand and gravel with which it is



### This Water Pail Folds Up

**A WATER** pail as part of the portable equipment of the camper, fisherman or motor tourist, is possible now that one has been designed which folds into a flat, convenient size. As illustrated above, it has curved sides, with a metal bottom and rods to keep it in shape when in use. The handle is also of metal. The top photo shows how compactly it can be folded together.

### Dry Hay while Sun Isn't Shining

**SUNSHINE** may no longer be requisite in hay making, with the invention by Arthur Mason, of Chicago, of a new crop-drying machine. In a recent demonstration, one hour elapsed between the placing of fresh-cut, green alfalfa in the machine and the removal of dried alfalfa meal in bags. The same process would have required at least two days with sun drying, and the value of the crop would have decreased from fermentation and depreciation.

The machine forms a mat of cut alfalfa eight inches thick and carries it on an endless belt through a hot air furnace that removes all moisture in forty minutes. The interior length is about 150 feet. After drying, the crop goes through a chopper and is then raised into a loft by a mechanical blower.

Farmers are said to be enthusiastic about the new invention, which would make hay drying independent of the weather.

### Develop New Camera Film

**THE** invention of a new photographic film, said to be equally sensitive to all colors, is expected to bring about interesting changes in motion picture work. No more heavily plastered make-up may be necessary for the actors, and the director will be able to arrange the setting knowing that the scene will appear on the screen as it does to his eye. In color photography, as well, the invention promises to make possible motion pictures in perfect natural colors.

**A REAL DOLL**, "vamp" has been created by a toy maker in Germany. The eyes and eyelids move in all directions in striking resemblance to human eyes.

### Weather Maps Sent by Radio



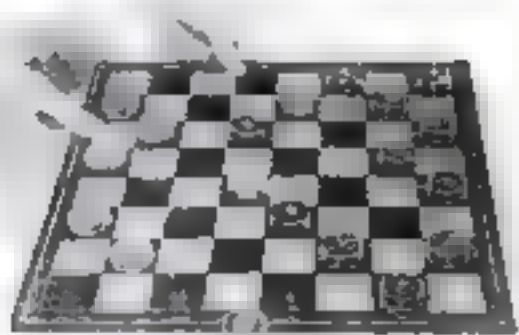
Receiving a weather map by radio. The photo shows the delicate receiving apparatus with the stylus which traces the map

**SHIPS** at sea may now receive not only marine weather reports but complete continental weather maps as well as a receipt for a new radio transmitting device.

The instrument invented by C. Francis Jenkins, of Washington, D. C., includes a receiver with a recording stylus that traces in ink the curves of the map being transmitted from a land station. Rubber mats protect the delicate apparatus from shocks and vibration,



## "Traffic As Usual" on a Moving Bridge



### Magnetized Checkers Stay Put

**N**ONSKID checkers containing small horseshoe magnets are the latest novelty for checker players. The checker board is steel, so the magnetized pieces can't slide while the game is being played. Kept in a steel box when not in use, the checkers are said to retain their magnetism indefinitely.

### Muffles Locomotive's Noise

**L**OCOMOTIVES that glide along in peaceful silence are one miraculous result of applying the Maxim silencer war-time muffler of firearms, to industry. Eight American railroad systems have installed silencers of special design on their oil-electric locomotives.

Placed on top of the locomotive, the silencer filters out the sound from the exhaust by a carefully worked out series of sound reflecting planes which do not interfere in any way with the escape of gases to the atmosphere.

### What Electrical Devices Cost

**J**UST how much do your electric appliances—toaster, iron, and so on—cost to operate? A specially constructed test board was installed recently in a Montreal, Canada, department store to answer this question. When the appliance under test is plugged into the board, as shown in the photograph at the right, a dial shows the rate of consumption in amperes. Another dial registers the watts. The line voltage is shown on a voltmeter between the two dials. The scale of costs per 100 watts appears on one of the curls at the side of the board. Another curl gives the actual cost per hour in cents and fractions, at the local rate.

A comparative test in candlepower of the lamp bulbs on the lower part of the test board is given by the "vanes" under the switch plates.



**W**ITHOUT disturbing the normal flow of automobile traffic in the least, California engineers have succeeded in moving into place a new 6,000-ton bridge to take the place of the existing structure. When the old bridge at Montebello, just outside of Los Angeles

on an important artery highway, had been prepared for speedy removal, the new span, already assembled, was pushed into place with powerful jacks. Motorists drove unconcernedly across it as it slid on steel rails to its permanent position as shown in the photograph above.



Testing the current consumption of an electric hot plate. Note the dials that register the power needed to operate various electrical devices for the home.

### Chases Fog for Aviators

**F**OG is dissipated by a high-voltage electricity from a new apparatus tested by government engineers, intended to make landing fields safe for aviators. A path 1,000 feet high and 2,000 feet wide, it is said, can be cleared by the machine. The device throws upward a blast of air charged with electricity, which, meeting the fog, precipitates it as rain.

### Versatile Saw Run by Motor

**O**NE feature of handy cut-off saw at the right a new addition to labor-saving machinery, is that the weight of its electric motor keeps the swinging saw arm out of the way when not in use. When work is to be done, a convenient hand lever pulls forward the whirling blade and slices off any desired length of lumber with swiftness and precision. Power is supplied by an electric motor that takes its current from any lamp socket.



It saws wood, leather, fiber even steel tubes.

A versatile tool, the saw trims two by fours to size and cuts metal (e.g., bakelite, brass rods, leather and fiber).

**THREE CARRIER PIGEONS** were defeated by an airplane in a strange race recently between Hammondspoint and Albany, N. Y., an airline distance of fifty miles. The plane beat the first pigeon to arrive by three minutes.

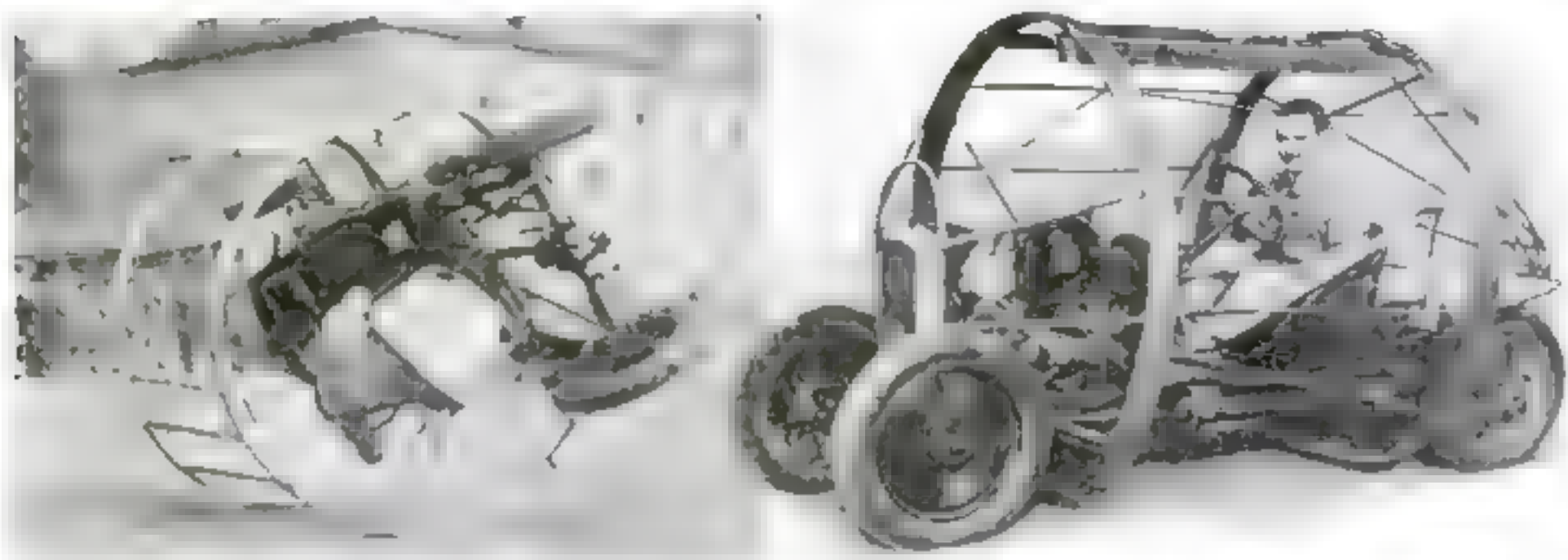
### Prehistoric Beasts in Plywood

**R**ECENTLY a series of plaster models of prehistoric creatures was made at the Natural History Museum, London, and from these designs were made for an unusual set of small models to be reproduced in plywood. The models offer an excellent means to study the strange dinosaurs and mammoths that once roamed the earth, and many schools, particularly schools for the blind, have already adopted them for instructional purposes.



This weird-looking animal is a diplocephalus. The model is one of a unique series depicting prehistoric beasts.

# Acrobatic Auto Rolls Over Sideways, Even Loops the Loop



**T**HE audacious young automobilist, rolling along upside down, above, is Andre Merrier of Paris, France, and the vehicle with which he defies death is a little five-horsepower European motor car

completely enclosed in a heavy steel cage. Not particular about which side up he lands, Merrier makes his extraordinary machine stand on end, roll over the ground, or loop the loop at will, by

putting on the front wheel brakes while driving at top speed. This capsize the car, which then rolls over and over on the sturdy metal hoops that inclose it, and finally comes to rest undamaged.

## New Harvester Fights Corn Pest

**S**PECIAL harvesting machinery designed to end the reign of terror in Ohio's farming territory of the European corn borer, evil genius of the "corn plague," was tried out extensively in recent months in the infested areas. Since the pest hibernates in the base of the stalk, the harvesters are designed with extra low cutting blades to cut the stalk close to the surface of the ground leaving no stubble. The borers are thus removed with the stalks, to be crushed in the husking process. The low cutting is said to reduce materially the size of the next year's brood of corn borers.



## Hawk Nests on Telephone Pole

**M**YSTERIOUS leaks and cross-talk on a New Jersey telephone line were traced finally to the hawk's nest above. Made of driftwood and seaweed, the nest is impregnated with salt. In wet weather the salty moisture allowed current to flow from one wire to another.

## Goggles for "Aviator's Blindness"

**W**HEN Commander Richard E. Byrd flew to the North Pole last spring, the glare of the sun's rays reflected from the limitless expanse of dazzling snow gave him an acute case of snow-blindness. Even in ordinary flights, aviators' eyes suffer strain from light reflected from below, reaching their eyes at an unaccustomed angle and falling on a part of the retina that is little used to strong illumination.

To relieve eye strain incidental to flying, a new type of aviator's goggles is being developed at the Brooklyn Navy Yard and Rockaway Beach, N. Y. The problem is to produce an eyepiece of the highest optical perfection, to eliminate the danger from imperfect or distorted sight, fatal to airmen, and at the same time to shield the eyes from the most injurious light rays.

It is expected that the glass used will be yellowish-green in color, thus absorbing a large proportion of the harmful light without materially dimming vision.



Even the nose provides space for a sign

## Odd Roadside Sign

**A**RMS, hat, even the nose and silhouette of the fantastic figure at the left, carry warnings and directions for motorists who pass this strange signpost erected at a crossroads in Castine, Maine. The figure is made of wood, painted white, and seldom fails to attract tourists' attention.

## Phantom Dance Uncanny If You Don't Look Close

**A**LL the vogue in London phantom dancing has recently struck the United States. You find it uncanny, unless you know the explanation. The dancers go through their steps perfectly and in exact rhythm, but no music is heard.

Fitted over the dancers' heads, however, are radio headpieces. They are stepping to radio music which cannot be heard by the persons watching them.



Dancing in Castine is performed in a room of mysterious lighting

## Hydrogen Turned into Helium

**T**HE remarkable feat of changing hydrogen into helium for use in airships, is reported by two professors of Berlin University, Germany. The process as described consists of the rearranging of the individual electrons within the atom, putting off the unnecessary ones, fine particles of metal causing this reaction merely by their presence.





### New Speed Typing Like Printing

**T**YPISTS who have all they can do to manipulate the forty-odd keys on the ordinary single alphabet typewriter may groan at the thought of a keyboard with 1,160 letters and forty alphabets. But this seemingly complicated keyboard on a remarkable new typewriter invented by Fred A. Dolph, of Washington, D. C., was designed especially to make writing easier and faster.

Each alphabet lies in a single vertical line, as shown in the picture above, and each line has three shifts, for capitals, characters, and release. The operation is simply to press down the desired keys, from left to right, the forty rows across. To space, it is merely necessary to skip a key. Then when an entire line is "set," a lever is pressed which prints the line.

### Crushes Mountains of Ore

**A** NEW gyratory iron ore crusher has just been completed for use in the Maligan ore fields, which can handle 2,000 tons of it in an hour and crush the rock to nine-inch size. It is the largest ore crusher ever built, and its entire weight is over half a million pounds.

### Mother Hears Baby, Upstairs, by "Radio"

**W**ITH the aid of an ingenious application of radio apparatus, devised for her by Frank Lester, of New York City, Mrs. Benjamin N. Fishman, of Richmond Hill, N. Y., can keep as careful a watch over her sleeping baby, while seated comfortably on the front porch, as though she were upstairs.

A microphone lying on the side of the baby's crib is wired to an audio amplifier which operates a loudspeaker on the porch, transmitting the first waking wail of the sleeper or any other warning sound.

The loudspeaker may be moved to the

## Signals Stop Long-Winded After-Dinner Talks

**W**ITH a broad hint on the banquet table like the device illustrated at the right, after-dinner speeches may lose their terrors and listeners may be reasonably sure that the speaker will not stretch his two minutes to twenty.

A green light signals "start talking"; a red, "time's nearly up"; red, "stop now, sit down." With warnings so impersonal and so unmistakable, daring is the man who dis-



regards them. Electrical engineers made this unique use of an electric traffic signal at a recent banquet.

### A Master Whittler's Triumph

**W**HITTLED almost entirely out of wood with a pocketknife, the remarkably complete working model of a locomotive illustrated at the left is the work of Edwin Nunn, of Cincinnati, O.

It is a scale model, equipped with all modern improvements and in complete working order, even to the air brakes, which also function practically and are the only parts not made of wood.



Edwin Nunn, pocketknife expert, with the model of a locomotive he made. The air brakes are the only parts not made of wood.

### Giant Squash Weighs 115 Pounds

**O**NE thousand pumpkin enthusiasts were provided with one piece each of their favorite delicacy when this enormous specimen was handed over to the pastry cook after being exhibited at San Leandro, Calif., recently by William Fustera, who raised it. It was all one man could do to lift the squash, which weighed 115 pounds.

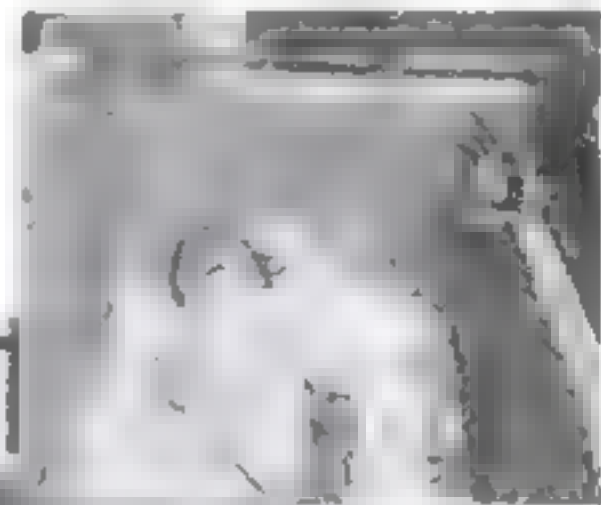


This pumpkin made two hundred pieces.

### How Colored Lights Affect Us

**N**EW discoveries about colored lights and their effect on human efficiency may have an important application in the illumination of factories and offices. In recent tests conducted in Vienna, it was found that under yellow light we see printed letters more accurately; under blue light, more quickly.

In the experiments, the persons tested looked at letters printed on cards, like the cards used by oculists. Four lights were used—white, yellow, red and blue. All had the same intensity. More letters were identified under the yellow than under the other lights. However, when only a brief glimpse of the cards was permitted, the best identifications were made under the blue lights.



The microphone, or sending unit, is attached to the crib above. The baby's voice is transmitted through it to the loudspeaker, which can be moved to any room desired.



# Inventions to *Lighten*



## Every Slice Alike

Every slice of bread is cut straight and with machine-like evenness of thickness, with the new bread-cutting outfit shown below. A slot between two upright metal loops guides the bread knife. At the bottom a stop can be set for any thickness.

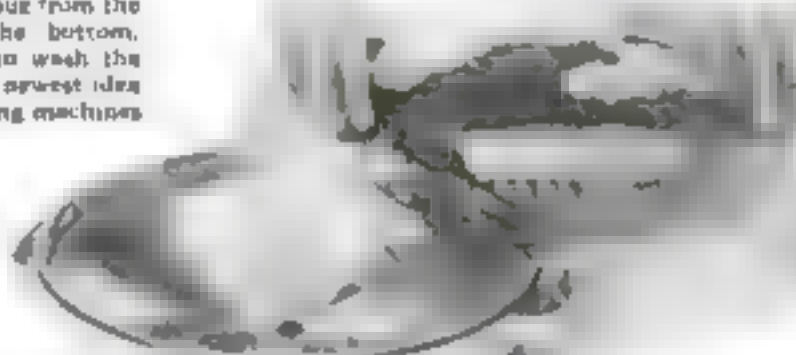


## All the Scrubber Needs

Soap and brush go with this handy housecleaning pail above, contained in a built-in basin attached to its base. The built-in basin catches any dirty or soapy water that happens to run down the outside of the pail.

## Puts Power in the Washtub

Stand the queer looking tube above in a laundry tub and a jet of water will issue from the perforations in the bottom, powerful enough to wash the clothes. It is the newest idea in electrical washing machines.



## Saves Soft Knees

She who scrubs floors will appreciate the comfort of soft cushions in this new scrubbing coaster above. Rolling smoothly on ball bearing casters, it is upholstered to fit the knees.

## A Non-Grease-Spattering Broiler

In the ingeniously designed broiler above, grease runs down a funnel-shaped false bottom through a hole into the pan below, thus preventing the nuisance of spattering and the danger of grease catching on fire.



## For a Neat Job at Egg Separating

It's easy to separate eggs with an aluminum separator that fits into a glass or cup above. Whites run off through slots, while the unbroken yolks of the eggs remain in the separator.



## Bath Stool Becomes Shoe Shine Box

A touch is all that is required to have this shoe shining apparatus (right) sink slowly down out of sight. The top may then be closed forming a handy stool for the bathroom.

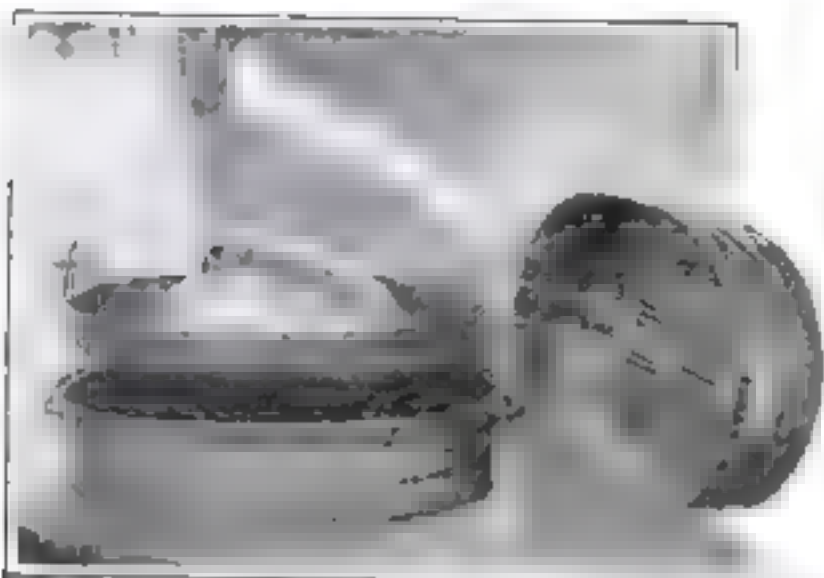
## Nightrack

A hanger for your coat, another for trousers, and hooks for all the remaining articles of a man's attire keep them in shape overnight on this handy rack above. Even shoes are hung from hangers fastened to tiny chains.





# Household Tasks



## Needs No Basting

The unique toaster illustrated at the left is self-basting. Bastes from the cooking meat condensates on the top and drips down on slices of bacon may be placed on the rack on the cover and their drippings add to the flavor of the meat.



## Dries Wash Indoors on Rainy Days

Whether the sun is shining or it is raining, patchforks outside the week's wash can quickly be dried in the gas-heated laundry dryer illustrated above. A thermostat that automatically turns down the gas when the air gets too warm, making scorching impossible, is an interesting feature.

## A Labor-Saving Kitchen

Right: A typical electrically equipped kitchen of the modern housewife. Note the electric range, sink with built-in electric dishwasher, electric refrigerator—a whole routine of servants at the pushing of a button!—besides the kitchen cabinet and refuse chute to incinerator.



## Waxes and Polishes

Easily reversible, the weighted block of the floor waxer above has felt for applying the wax on one side, and cheesecloth for polishing on the other. Thus no changing of cloths is necessary in using.



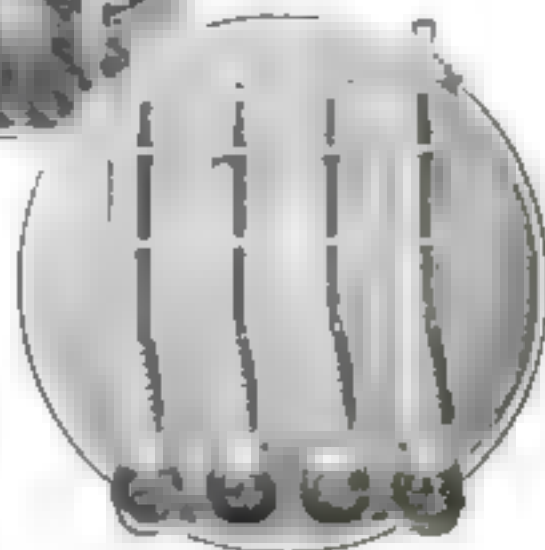
## Pot Scraper Does Double Duty

With a rubber blade at one end and a metal one at the other, this little scraper (left) does its after-dinner job with double efficiency. The rubber end is for plates, the metal for cooking pots and pans.



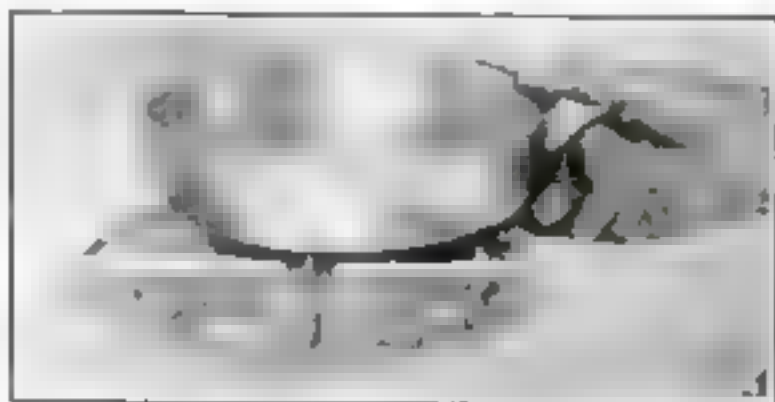
## This Garbage Pail Drains Itself

The bottom of the removable inner pail of the refuse receptacle at the left is perforated to let liquids escape into the larger pail, lessening the danger of clogged sinks. The entire aluminum receptacle swings conveniently from a clamp attached to the sink drain.



## Toothbrush Hygiene

At the bottom of each of the novel glass toothbrush containers above is a pink charge of sterilizer that keeps the brush fresh and free from germs.



## Aluminum Plate Subs for Double Boiler

Food won't burn when it is cooked over this ridged aluminum hot plate, says the maker. It keeps the cooking unalloyed from direct contact with the flame.

# How to Hook Up a Radio Set

*With the Right Kind of Equipment, Carefully Installed, Your Receiver Can Be Made a Marvel of Simplicity*

By ALFRED P. LANE



## It's Child's Play

Although receivers and accessories are constantly becoming more complex and highly developed, the actual operation of an up-to-date receiver is so simple that even a small child can tune it.

**T**IMES have changed as far as radio installations are concerned. It is no longer good form for the man of the house to install a radio receiver that has a dozen or so complicated control knobs, and then make matters worse by connecting up the batteries and other accessories in such a way that no one in the family can figure out how to run the set.

Fortunately enough, the actual use of a radio receiver has been steadily growing more simple, even while the receivers themselves and the accessories that go with them have become more complex and highly developed.

In spite of the elaborateness of the modern radio installation, its control can be made so simple that practically any of the present-day models are easily tuned by any member of the household, including their children. However, these desirable results can be obtained only if the installation work is carefully done and if the accessories that go with the set are capable of rendering good service for long periods of time without attention.

The temptation to buy an expensive set and then skimp on the other necessary parts of the equipment is responsible for a great deal of trouble. If, for instance, you have decided to invest \$400 in a radio receiving equipment, it would be better to buy a \$100 set and spend the rest on high class accessories than to buy a set for \$175 and then try to run it with \$25 worth of inferior accessories. The same principle applies, of course, regardless of the total amount involved.

**S**UPPOSE you buy a standard five-tube radio receiver of any make or price. This receiver will come to you carefully packed in a carton to protect it from injury. Inside the carton you will find nothing but the set and an instruction book. Before you can get the set into operation you will need all of the following accessories:

A set of high grade vacuum tubes consisting, for best results, of four standard type tubes and one of the new power tubes.

A six-volt storage battery to run the tubes, called the A-battery.

A storage A-battery charger.

A set of dry cell B-batteries or a B-battery eliminator.

A loudspeaker.

Antenna equipment.

If your decision is in favor of the B-battery eliminator instead of the dry cell B-batteries, another piece of equipment will be found well worth while. That is an automatic switching relay to turn the B-eliminator on and off and control the trickle charger as well.

A diagram of a complete installation, showing all of these items, appears on the opposite page.

Your dealer will be glad to help you in the choice of good equipment for your set, but the decision as to what to choose necessarily depends largely on what kind of results you expect and how far you are willing to go in the matter of expense. On some of the equipment there is considerable latitude, while on other items there is practically none. Take vacuum tubes as an example. The best grades are only slightly more expensive than the "bootleg" variety, and there is no comparison between good tubes and second rate tubes as far as long life and full volume are concerned.

**S**TORAGE batteries, on the other hand, are made in a wide variety of styles and at different prices. All of them are rated in ampere hours, and you can figure that your five-tube set will run approximately two thirds as many hours as the rating of the battery expressed in ampere hours. But if you buy a trickle charger which will keep the battery fully charged at all times, the capacity is of little importance. In fact, if you buy a trickle charger it is desirable to purchase a small capacity battery, because the internal losses will be less and so will the purchase price. A battery of about forty to sixty ampere hours is large enough for any five-tube or six-tube set under these conditions.

It will be up to you to decide between a set of dry cell B-batteries and a B-eliminator. The dry batteries will be cheaper to start with, but the B-eliminator will be cheaper in the long run, particularly if you use the set for many hours a day on the average.

Perhaps the most important item of all is the loudspeaker. You can get one at almost any price, from \$5 up to \$100, and if you buy a reliable make you will get your money's worth anywhere along the line. It is all a matter of tone quality and volume. Your own ear will have to decide.

Antenna equipment has been placed last on the list because the antenna you can erect and consequently the material you will have to buy, depend entirely on your location. An antenna of some sort will be necessary, of course, unless you purchase a loop-operated set.

**Y**OU may, for instance, be living in a city apartment where no outdoor antennas are permitted. In that case a half pound of ordinary bell wire, costing about thirty cents, is arranged in the picture molding, which gives the first kind of indoor antenna. On the other hand, you may live in the country where a long outdoor antenna is possible, and you will need antenna wire, insulators, lightning arrester, ground connection, and possibly a pole from which to string the antenna.

Constantly keep in mind the fact that you want your installation to be suitable for use by any member of the family. This means that it must be made absolutely fool proof as far as the various portions of the equipment are concerned. You can have a regular power plant with all the gadgets and break switches you want, provided it is enclosed in a cabinet placed in a near-by closet or stored away in the cellar so that the members of the household will have nothing to do but turn one switch and turn the dials to the desired station. An installation such as shown in the diagram will give you exactly this result. Everything except the set can be placed out of the way where you can give it periodic inspection and



## For Two Antennas

If you wish both indoor and outdoor antennas, this single pole double-throw switch is the simplest arrangement. Connect the antenna binding post of the receiver to the center terminal of the switch, and the antenna wires to the remaining terminals. Then you can throw the switch to either



attention. When the switch on the set is turned on, the current flowing through the automatic relay turns off the trickle charger and turns on the B-eliminator so that the set is ready to use. When the switch on the set is turned off, the current flowing through the relay is cut off too, and it snaps back to its original position, shutting off the B-eliminator and putting the trickle charger to work again.

The illustration, for the sake of clearness, shows all of the accessories as separate instruments. You can buy them in this way or in several different combinations. The storage A-battery and the trickle charger may be combined in one case, or you can buy a B-eliminator that includes the trickle charger for the A-battery and the automatic relay. Of course, any of these combination outfits will simplify the wiring job.

**T**HE attention required to operate such an outfit is almost negligible. You don't have to test the battery with the hydrometer every so often to see if it needs recharging. In fact, all that is needed is an occasional inspection to make sure that everything is working properly, and additional supplies of water at intervals for the storage battery and for the trickle charger if it happens to be of the liquid type. When you wind the clock on Sunday you can form the habit of spending a couple of extra minutes inspecting your radio equipment. Forget it completely the rest of the time.

Of course you cannot expect fool-proof service from your radio equipment unless you install it carefully. Sloppy connections and loose dangling wires are bound to cause trouble in time. If you have the power supply accessories in a closet or in the cellar, for instance, make sure that the wires are fastened down wherever they are visible.

**I**N MANY localities, especially where there are a number of local stations, it is desirable to have both an outdoor and an indoor antenna. The outdoor antenna will be useful to bring in semidistant and distant stations, and the indoor antenna will be fine for receiving the local broadcasting, particularly when the static is heavy or there is a thunderstorm in progress. The simplest arrangement to avoid loose wires is to use a single-pole throw switch, as shown in the illustration on page 58. Connect the antenna binding post of the receiver with the center terminal of the switch, and connect the wires for the two antennas to the remaining terminals of the switch.

The question frequently arises as to how far from the receiver the power supply units and the loudspeaker may be placed. As far as the loudspeaker is concerned, it may be placed at almost any distance from the receiver without diminishing the volume or affecting the quality. The B-battery eliminator or dry cell B-batteries also may be placed at any desired distance from the set, provided the wires from them are bunched together. Sometimes a steady squealing noise is produced

## What You Need for Radio Satisfaction

1. A good receiver.
2. High grade vacuum tubes.
3. A reliable storage A-battery.
4. A storage A-battery charger.
5. Large-size dry cell B-batteries or  
A dependable B-battery eliminator.
6. Dry cell C-battery.
7. A true-toned loudspeaker.
8. Correct insulation.
9. Periodic inspection.

when the B-batteries or B-eliminator are placed many feet away. A squeal of this kind always can be stopped completely by connecting  $\frac{1}{2}$  or 1 mfd. by-pass condensers between the B-battery binding posts of the set. Make sure that the condensers you buy for this purpose are capable of standing the voltages without breaking down. Connect a condenser from each of the plus-B binding posts to the minus-B binding post.

The storage A-battery should be placed within six feet of the set unless you use heavy wire to connect it. In most cases it is not necessary to put the battery more than twenty or thirty feet from the set. For this distance use wire not smaller than No. 12 gage.

While radio vacuum tubes are now sold at reasonable prices, you will want to know how to make sure that you don't burn them out through an error in connecting up the power supply units. The best way to do this is to run the wires from the binding posts of the storage battery to the binding posts of the set before you do anything else. The red binding post on the battery must be connected with the binding post on the set that is marked plus A. If you are installing an automatic relay, one binding post of the

relay should be connected with the remaining terminal of the storage battery and the other terminal of the relay should be wired to the minus-A binding post on the receiver. Next put all the tubes in the sockets and turn on the switch on the set. If the tubes light and there is a slight click from the relay each time the switch on the set is turned on or off you can be sure that your hook-up is correct up to that point.

**B**E CAREFUL not to get the battery terminals reversed, as the set will not operate, although the tubes will light and the relay will click.

Radio fans who have used dry cell B-batteries are often confused when they attempt to connect a B-battery eliminator for the first time. The binding posts on the eliminator should be connected with the binding posts on the radio set that are marked the same way. If it happens that there are more binding posts on the eliminator than there are on the set, connect the binding posts on the set with the similarly marked ones on the eliminator and leave the remaining posts on the eliminator unconnected.

After you have the eliminator hooked up, snap the electric light plug of the eliminator into the socket in the relay that is marked B-eliminator. Next connect the trickle charger with the storage battery, making sure that the red, or plus, terminal of the trickle charger is connected with the red terminal of the storage battery, and then snap the plug from the trickle charger into the socket provided for it in the relay. Then you can snap the plug from the relay into the nearest electric light socket.

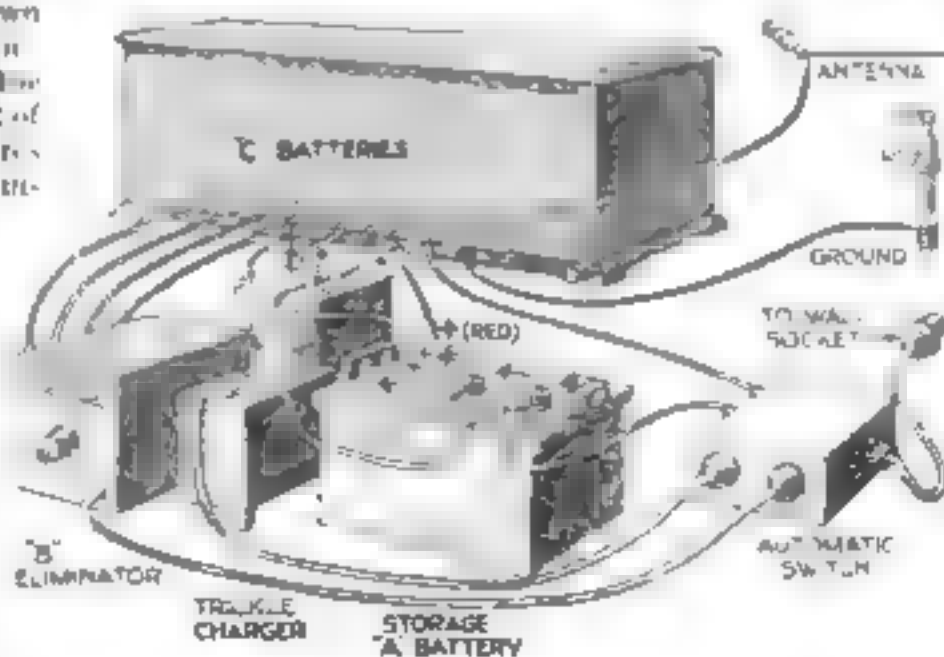
**R**UN a wire from the ground binding post of the receiver to the nearest cold water pipe. It is desirable theoretically to have this connection short, but actually it makes little difference whether you connect with a water pipe right beside the set, or with one in the next room.

There is no mysterious art required in putting up a good radio antenna. All you need is a metal wire from the antenna binding post of your receiver about 100 feet long and as high as local conditions will permit. Make sure that it touches nothing except an insulating material, from the free end to the binding post of the receiver.

In putting up the average outdoor antenna, three insulators are used. One is placed at each end, and a porcelain tube insulator is usually employed to carry the wire through the wall.

Local conditions govern the type of antenna to erect. You may not be able to put up an antenna 100 feet long. In that case put up as long a one as possible. Reception of distant stations will not be so good, but a short antenna will be just about as good as a longer one for the local and semi-distant stations.

Careful attention to the details of a radio installation will insure you continuous service without trouble or expensive service calls.



An Installation That Needs Little Attention

A complete installation which will give you the simplest operation and most satisfactory results. All the wiring connections are indicated. In actual use the battery, charger and B-eliminator are hidden elsewhere.

# What a Bargain Radio Did to Me

As told to  
NEWTON BURKE

*It Cost Me More in the End  
Than an Expensive Set, in  
New Parts and Service Bills*

"HENRY! Just read this wonderful bargain!" exclaimed the wife enthusiastically. She folded the evening paper to indicate the advertisement that had caught her eye and passed it across the table.

"Humph!" I grunted noncommittally. "I thought you said you didn't want a radio. What's so marvelous about this one? Seems to have the usual number of gadgets on the front, as far as I can see."

"But it's a special sale, Henry, and they give you all the batteries and loudspeaker and everything free!"

The ad did look appealing. I'd been thinking about getting a radio receiver for some time. Here was a chance, I thought, to get the whole works without having to do a lot of shopping around, and if there was any prospect of holding the money out of the family budget for a radio set, now was the time. Hadn't the good wife suggested it herself?

I stopped at the store next day on my way home from the office. They had a set on demonstration. It looked pretty good to me. And the salesman explained that the tone quality would be much better in my own home because, he said, the store didn't have the proper acoustic qualities.

He brought out a long form printed in very small type which he said was the standard sales contract, and I signed it.

The next night my wife was waiting for me at the door of our apartment when I came up on the elevator.

"It's here, Henry!" she greeted me. "The radio is all ready and I'm just crazy to have you get it going. The man told me how to start it, but I was afraid I might break something. Please start it right away."

She wouldn't even give me time to take off my coat. I sat down in front of the shiny new outfit and reached for what appeared to be a switch. My guess was right, for music could be heard faintly from the loudspeaker. I turned the dials back and forth until I had the music good and loud. But my wife held her hands to her ears and her face registered keen disappointment.

"SOUNDS kind of sour," she protested. "It certainly does," I replied. "Maybe it's a little green like a sour apple and it will get ripe and mellow after we use it a while."

We let it remain turned on during dinner, and about the time we reached pudding and coffee the music suddenly stopped.

I walked over to investigate. The switch hadn't snapped itself off. I tried it to make sure, and then lifted the top of the cabinet to see if I could find the trouble.



## The Worst Was the Sounds It Made

When my wife first heard our wonderful "bargain set," she thought its tone quality terrible. But we got used to it and finally didn't realize ourselves how silly it was, until our friends joked us into hearing a good set. Then we canceled our bargain junk.

"That's funny," I said. "One of those lamp things seems to have gone out."

There was no more radio that evening, and the next morning I called up the dealer. He carefully called my attention to the fact that radio vacuum tubes were not guaranteed and explained that sometimes they did burn out very quickly. I had him to send up a new one. It cost two dollars.

THE next night the set worked all right, and every night after that for a week. Then another tube burned out. I had it replaced. Three days later a third tube passed on, and about that time I decided that radio was a pretty expensive amusement if I had to spend from two to four dollars a week for new tubes. I also decided that some other dealer might have tubes that wouldn't burn out so quickly, so I wrapped up the latest casualty and took it to a small radio dealer near my home.

"Where'd you get the alleged vacuum tube?" he inquired as soon as he had opened the package.

"It came with the set I bought," I replied.

"I thought so," he said. "That's what they call in the trade an 'equipment tube.' I suppose you want a good one now."

"Five of them, please," I answered. "I might as well have them handy when the rest go out."

My soreness over the vacuum tubes was just beginning to die out a week later when right in the middle of an interesting program the music began to get weak.

I turned the volume control up a few notches and brought it back to the proper level. After this happened a couple of times I turned the volume on full, and then I had to sit there and listen while the music got weaker and weaker and finally died away altogether.

"Now what's the matter with your fine radio set?" my wife inquired disgustedly.

"How should I know?" I returned peevishly. "I'm no radio expert and it looks like the fellow who put this thing together wasn't one either."

I raised the cover again. While the tubes were lighted, they seemed to be glowing very dimly. I shut it off and phoned the dealer.

"Is your A-battery run down," the service man suggested.

"Should it run down that quickly?" I asked in surprise.

"Sure, you ought to have a charger," he answered. "We have some very good ones for \$10.95. Should I send one up?"

"I thought this was a complete outfit I bought," I snapped. "You needn't bother to send up any charger. I'm sorry I had enough now." And with that parting shot I hung up the phone and called on the local dealer again.

The set worked all right for a month after that, and then the music and voices began to get weaker and weaker and mixed up with scratching noises. I called in the local dealer, and learned that the B-batteries were dead.

"These are 'equipment' batteries," he explained. "They aren't made good to start with, and besides that the set isn't wired for a battery, so it takes more current than it should. You ought to have the large-size batteries anyhow."

I TOOK his advice and had him put in a set of large-size batteries, but my troubles had only begun. The loudspeaker went on the bum and had to be fixed. Then the set went dead and one of the transformers had to be replaced. All of these things were replaced free by the firm from which I had bought the set, but the joker turned out to be a bill for "service calls" at the rate of three dollars each!

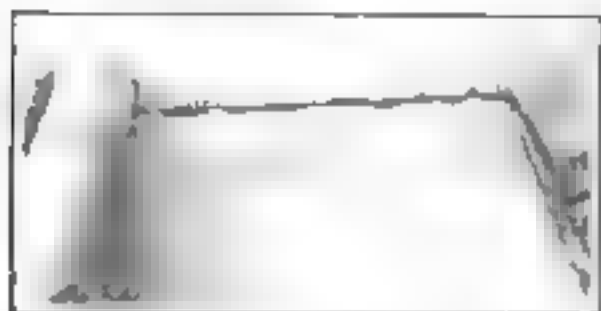
I might still be contributing to the support of that concern if some friends of ours hadn't joked us unmercifully about the rotten tone quality of the set even when it was working right. My wife and I had sort of got used to listening to its tinny music, but one evening we went around to the local dealer and he gave us a demonstration with a good set. We hadn't realized that radio could be so perfect, and the set he demonstrated is now installed where the bargain junk used to be.



# Hints for Radio Beginners

## If Sleet Coats Your Antenna—

*Rig Up a Sash Weight to Prevent Breakage Locating a Hum Other Helps*



This type of joint will stand as much strain as a continuous wire. Be careful not to nick the wire with the pliers.

**W**HILE it always is a good idea to use a single, continuous piece of wire for an antenna or for the lead-in, you may want to use some short lengths to make up a temporary antenna or to piece out an exceptionally long one.

Twisting the wires together in almost any fashion will do as far as getting electrical contact is concerned, provided that the twist is tight; but more care than that must be taken if the joint is to stand the strain produced by a severe windstorm or by sleet deposited on the wire.

The illustration above shows the best way to make a joint that will be as strong as the wire itself. Note that several easy turns are followed by sharp turns in such a way that the pull does not come at a point where the wire has been weakened by a sharp bend. In making a joint of this type, the pliers should not be used except to clamp down the tip end of each wire as shown. The reason for this rule is that pliers put nicks in the wire and if a break occurs it takes place at the nick.

A joint made in this way, and that is subject to continual strain as in an antenna, offers little resistance to the flow of either high or low frequency electric current until it has become corroded with age. It is always better to flow solder into the joint so that it will not lose its electrical conductivity. The joint should be strong enough to stand the pull, however, without relying on the strength of the solder.

**T**HE most severe test to which any radio antenna can be subjected is the weight of a heavy deposit of sleet. The strain or pull on the wire depends to a considerable extent on how tightly it is stretched, and it is good practice to loosen up on the antenna and let it swing in a deep curve whenever a sleet storm threatens. A way to rig your antenna so that this will be taken care of automatically is shown in the diagram at the bottom of the page. The only extra material you need is a small galvanized iron pulley and a sash weight. As the sleet begins to collect on the antenna wire and increases the pull, the antenna will sag

and the sash weight will be lifted. When the sleet melts the weight will pull the antenna back to normal position. The length of the antenna will determine the amount of weight that will be needed to keep it taut.

### What Causes the Hum?

**S**O LITTLE hum is produced by the modern type of B-battery eliminator that it is barely perceptible if you hold your ear close to the loudspeaker when no signal is tuned in. Sometimes, however, the step-up transformer in the B-eliminator will produce a slight hum that has nothing to do with the radio-receiving circuits. In fact it is exceedingly difficult to produce an alternating current transformer that is absolutely noiseless when operating at full load. The noise is produced in the transformer by the vibration of the thin sheets of iron that make up the core.

The way to find out whether the slight hum you hear is coming out of the loudspeaker or is produced in the B-eliminator is to disconnect the antenna while the set is in operation. If the hum continues, you may be certain that it is not in the electrical circuit to the loudspeaker. You can muffle the hum produced in the B-eliminator by placing the instrument in a near-by closet.

### There's No Cure for Fading

**T**HE causes of "fading" have been discussed by electrical scientists and several theories have been evolved to account for the phenomenon, but up to date no remedy has been discovered. If you are bothered by the signals alternately becoming weak and then strong again while you are listening to any station that is more than twenty-five miles away, and you have tested to make sure that the trouble is not due to a loose or defective connection in your set or battery wiring, you can rest assured that any other set of any make would produce exactly the same effect if it were used in your location. Do not waste any money on de-

### A B C's of Radio

**N**INE tenths of the trouble calls, so the radio service men say, are caused by dead tubes or exhausted batteries. A large proportion of the difficulties remaining after these two sources of trouble have been eliminated can be traced to loose wires. Another big percentage is chalked up against difficulties for which the radio equipment is not to blame, such as static or the interference from some form of electrical machinery.

If your set produces queer scratching or buzzing noises, disconnect the antenna and see if the noises continue. If they stop, you may be sure that there is nothing wrong with your set. If they continue, look for a loose connection in the battery wires or a tube prong that is not making perfect contact with the spring in the socket.

When your set goes dead, test the B-batteries, then the A-battery; after that, if necessary, take your vacuum tubes to a reliable dealer who can test them for you. By following these suggestions you may avoid expensive service calls.

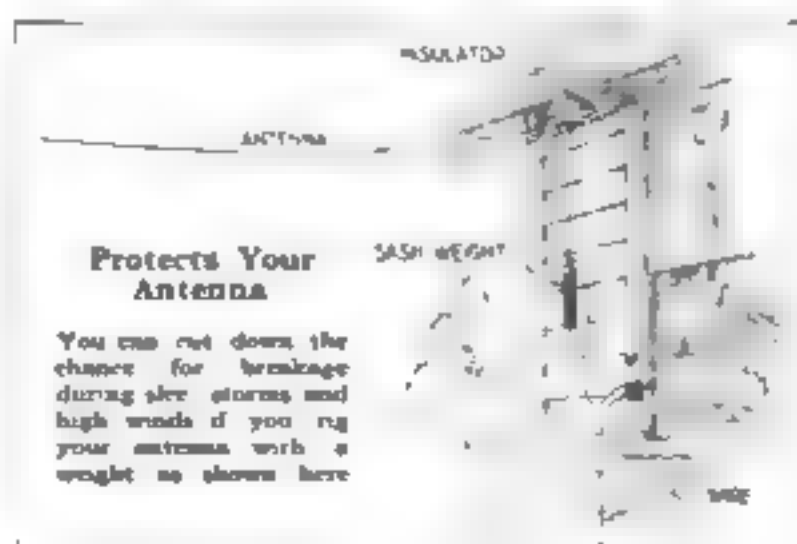
vices sold as a cure for fading, as such devices cannot improve conditions in the slightest.

Of course a more powerful set may help somewhat, because it will raise the whole level of signal strength so that the signal may be heard at its weakest instead of disappearing entirely.

### The Right C-Battery Voltage

**W**HILE the C-battery may, with some types of audio transformers, improve the quality of reproduction, the main advantage in its use lies in the fact that it adds to the life of the B-batteries by cutting down the amount of current drawn from them. In addition, the use of a C-battery will prolong the life of your vacuum tubes.

In most cases, of course, the best voltage for the C-battery is that recommended by the makers of the tubes used in the audio amplifier end of your radio set. Nevertheless, it is always well to experiment a bit, as tubes are not all alike and sometimes you may find that a slightly lower voltage will improve quality or that a slightly higher voltage can be used without impairing results. Always use the highest C-battery voltages possible without spoiling the music or speech, so as to prolong the life of your B-batteries and vacuum tubes.



Here's a New Test of Your Auto Knowledge—Win a Cash Prize

# What's Wrong with the Captain's Car?

See If You Can Figure Out  
What Happened to His Motor



**B**LAMED if the old craft ain't sprung a leak again!" muttered Captain Horne as a shrill hissing squeal indicated the sudden departure of the air from one of his rear tires. He jammed on the brakes and steered the car to the side of the road. "Reckon I'd better drop anchor here while I fix the dual-blasted 'hexones,'" he grumbled.

Captain Horne was no expert on autos, but thirty years spent in sailing the seven seas had instilled in him more than the usual share of resourcefulness and ingenuity. And the old sea-dog needed every bit of it to keep the car he was driving in running order.

He had been beguiled into buying a "reconditioned" machine, and the "reconditioning" had consisted mostly of a cheap paint job with little or nothing done to the badly worn mechanical parts.

"Holy mackerel!" he snorted as he found the blow-out. "The whole side of the tire is coming apart!"

The actual blow-out was only about the size of a pencil, but all around the hole the tire bulged ominously.

It was quite evident that even a blow-out shoe would soon let go, and the old car did not have one anyway. The spare tire had been used to replace a severe blow-out rather in the day.

Captain Horne scratched his grizzled head reflectively. "I can fix the hole in the tube, but it'll only blow out again through the hole in the shoe—I've got to brace it somehow," he decided. "Let's see what's in the locker."

**H**E PRODDED around in the tool box for a few minutes, until his hand closed over a large roll of friction tape.

"I've got it," he said. "I'll just patch the hole and then sort of splice it by winding a couple of layers of tape right on the tube. Seems to me I ought to be able to pump the tube to about the size it is in the tire, and then if I wind the tape on carefully it ought to take most of the strain off the shoe."

The captain took care to see that the tube was inflated just

enough to fit the inside of the tire, and the job was successful.

"There," he exclaimed, as he finished pumping it up. "That ought to hold together till I can raise the price of a new shoe. Now let's see if the old boat won't sail along."

But the captain was doomed to disappointment. He had proceeded about five miles when the motor suddenly appeared to lose power. It seemed to be running smoothly, no cylinders appeared to have quit the job, and the captain could detect no unfamiliar noises.

"Must be running out of wind or something," he observed uneasily. "Guess I'd better make for shore and tie up at the next repair station."

It happened to be a rather uninhabited part of the country and the captain passed one or two garages that catered only to the summer trade and were now closed tight. Every mile or two some-

## Did the Blow-Out Cause His Troubles?

A shrill blowing sound from one of the rear tires was the first warning that something was wrong with the captain's car. He patched the hole with tape, but that was only the beginning of his troubles.

thing seemed to happen inside the motor and it would lose more power, and finally he had to drop into first speed to climb a long but rather easy grade.

"If I don't make port soon I'll be becalmed here for the night," he gloomed, and his prediction seemed well founded, for at the top of the hill the motor stopped firing completely. No garage was in sight, but the car had passed over the ridge and he let it coast down the other side. The grade was so slight that the car barely kept in motion. In fact, at one place that was nearly level the skipper had to get out and put his shoulder to his craft to push it over. But his hopes perked up at the bottom of the hill where there appeared a brand-new garage with a young fellow standing in front of it garbed in new, clean overalls.

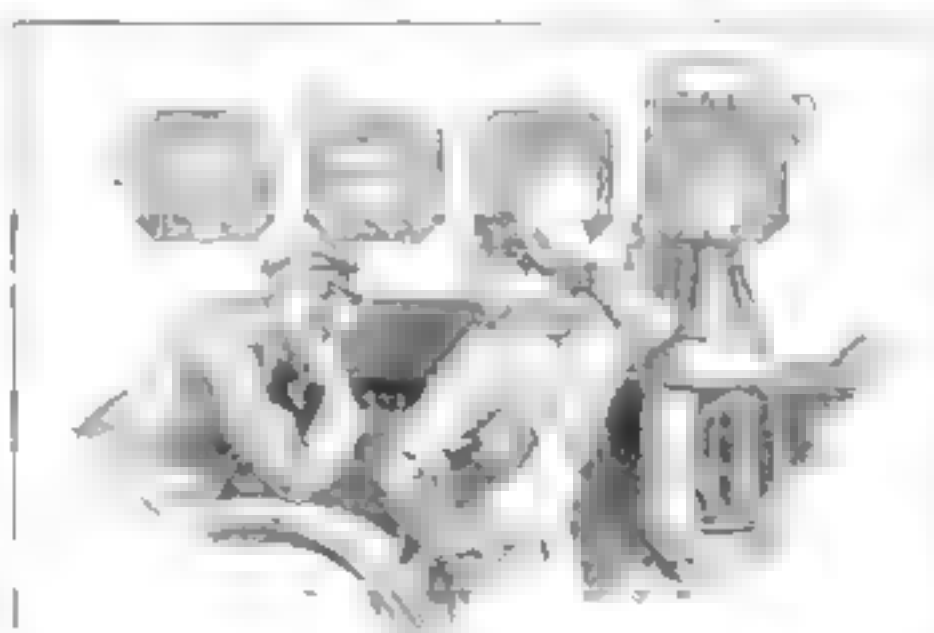
"Run out of gas, did I you?" the young man greeted the captain as he ran out and helped push the car to the garage.

"I don't see how that could be," Horne answered. "I filled up the tank just a way back."

**W**ELL, anyway, you came to the right place. The young fellow assured him. "I can fix anything on wheels. Just you wait."

The captain lighted his pipe and prepared to learn something about auto repairing. The young fellow brought out a new and shiny kit of tools and after the hood in a very businesslike manner. He stepped on the self-starter and the motor turned over at normal speed, but it did not start. Then he tested the ignition system. It too, appeared to be in running order.

"Here's your trouble," he announced finally, pointing to the carburetor filter screen he had. (Continued on page 129)



## Help Him Out and Win a Prize

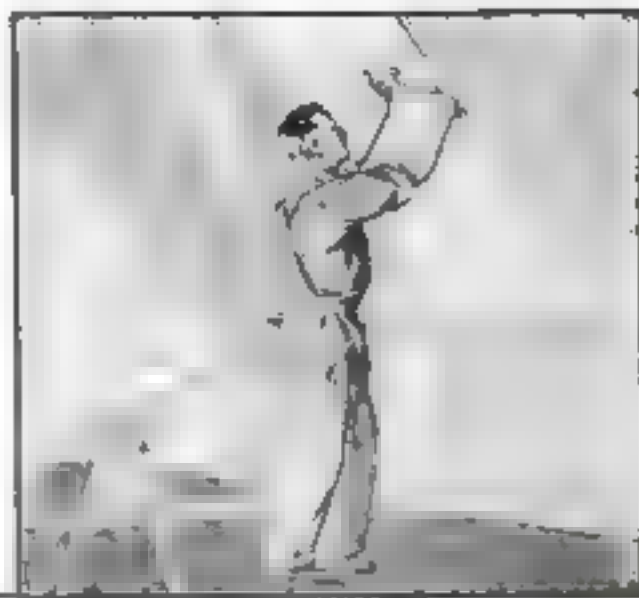
**P**OPULAR SCIENCE MONTHLY will pay \$25 for the best letter explaining the trouble with Captain Horne's car and tell us how to overcome his difficulties. Was the fault in the ignition? The carburetor? The battery? The vacuum tank? Even the garage man was puzzled. Your letter will be judged solely on how accurately you size up the trouble and suggest the remedy. Letters must reach us before January 31, 1927. Address: Automobile Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York City.





### for attics

Use Upson Board to build in useful rooms, at the same time insulate against heat or cold.



### for ceilings

One man can apply Upson Board right over cracked plaster with a permanently beautiful result.



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Upson Fibre-Tile will build snow-white water-proofed wainscotings—at about 1/10 the cost.



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## As useful as a hammer or saw!

**T**RY Upson Board for re-covering just one cracked plaster ceiling—or for building in useful rooms in home or store!

Then you will know why this dependable building material is in use in over a million buildings—with less than one complaint to every eight million feet sold and used.

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Properly applied, dependable blue-center Upson Board can never warp or bulge or crack or fall. It resists heat, cold, jars, moisture, fire and is the one board that can be applied without ugly nail marks.

We invite you to write for full size blue print, samples, helpful literature. Describe work you plan. The Upson Co., 127 Upson Pt., Lockport, N. Y.

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Enclosed find 10c for samples, literature,  
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# BOARD

partitions...insulation

# New Helpful Hints for Autoists

## Tire Inspection Made Easy—Sewing a Tube—Other Ideas

**I**NSPECTING the inside of an automobile tire for nails or breaks in the fabric is made easier by the simple, homemade device sketched in Fig. 4. Plenty of leverage is supplied for spreading the beads.

All you need to make the device is two boards of the dimensions given in the sketch, a hinge, two eyebolts and two strap iron hooks six inches long. The distance between the hinge and the eyebolt in the base should be about ten inches, and the eyebolt on the lever should be six inches from the hinge. Use standard strap iron for making the hooks.

### Stops Crank-Handle Rattling

**T**HE easiest way to hold the crank handle up out of the way of the license plate and to keep it from swinging back and forth continually and thus causing excessive wear on the bearing is to cut off a piece about  $1\frac{1}{2}$  inches wide from a piece of old inner tube either 20 by 4.40 or 32 by 4 size. After the lamp plug is removed from one of the headlights, the piece of inner tube should be slipped over the headlight and snapped around the crank handle as shown in Fig. 2. The quality of the rubber in auto inner tubes is so good that the band will last for a long time.

### Sewing Up a Blow-Out

**M**ANY motorists are under the impression that a tube is beyond repair if it blows out in a long rip. However, it is possible to save such a tube by sewing up the rip carefully with a needle and silk thread, using an overstitch that will bring the edges of the rent together smoothly. A patch can be applied with rubber cement in the usual way, and it is also possible to vulcanize the tube with a five minute vulcanizer by using the oblong patches and overlapping them until the rip is completely covered. Fig. 7 shows how to sew up the tube and apply the patch.

### Luggage Stored on Top

**A**S SHOWN in Fig. 3, the top of a increased auto body can be used as a fine luggage compartment that will hold extra coats, blankets or parcels and preserve them from dirt and rain. It is particularly useful for motor campers and long distance tourists.

The construction is very simple.



Fig. 6. If your fan pulley slips, hold it with special set screw.



Plywood and aluminum make this lunch kit light and strong. Fig. 1 (below) shows how it is fastened in place.



### Ten Dollars for an Idea!

**D. A. JEWETT** of Beaver City, Neb., won the \$10 prize last month for his suggestion of a device to make tire inspection easy. (Fig. 4.)

Each month **POPULAR SCIENCE MONTHLY** awards \$10 in addition to regular space rates to the reader sending in the best idea for motorists. Other published contributions will be paid for at usual rates.

this type is more suitable for such articles as rolled-up blankets, tents or other items that have no hard, sharp corners to scratch the material of the top.

### Plywood Lunch Kit Easily Made

**A** SUBSTANTIAL container for picnic lunches or campers' equipment can be made of three-ply wood, glued and nailed and covered with auto top material to render it waterproof. As shown in Fig. 1, it is lined with aluminum bonding strips and aluminum corners so that the construction is light and strong. Snaps, handles, knobs and springs are of the ten cent store variety. A feature of the container is the springs that hold the case on the special rack built up of angle iron and supported by the rear bumper. No straps are needed and the case can be removed in a second's time.

### Old Tube Fools Thieves

**A**N OLD inner tube that you may have on hand will make a good cover for the spare tire (Fig. 5). At a distance of a few feet it gives the appearance of an old tire that is worn, scuffed, or has been retreaded, and thieves are likely to pass it by. Cut the stem out of the old tube and slit it all the way around. The tension in stretching it into place over the spare will make it fit snugly without wrinkles.

### If Your Fan Pulley Slips

**I**F YOU are bothered with a fan pulley that keeps working loose, here is a way to remedy the trouble. Cut away part of the web as shown in Fig. 6 and drill and tap the hub for a hardened set screw. The pulley will stay in



Fig. 7. Careful sewing will often save a blown-out auto tube.

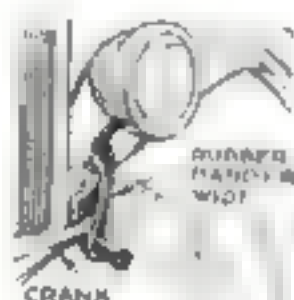


Fig. 2. How the crank handle can be held up out of the way so it will not rattle or hide the license.



Fig. 3. The top deck of a closed car converted into a fine luggage compartment by fitting with a house cover provided with snaps.

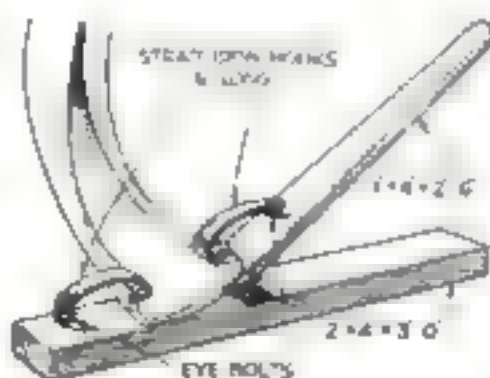


Fig. 4. Plenty of leverage enables you to inspect every part of the inside of an automobile tire with this simple device.



Fig. 5. An old inner tube will disguise your new spare tire so it will look old.

A row of snap fasteners should be placed at intervals around the edge of the top. A piece of auto top material can be cut to the proper shape and the socket part of the fasteners attached to it. Be sure to have the cover loose enough so that there will be room for as much baggage as you intend to place under it.

Of course a luggage compartment of

place. It is a good idea to spot the shaft with a drill through the set screw hole when the pulley is in the proper position to insure rigid clamping.



# Announcing

The Latest Invention  
of the Day-Fan Radio  
Research Laboratories

**Day-Fan**

# FANTENNA

**"First Aid  
to Aerials"**

**Makes Short or Inside Antenna  
Act Like a Long One—Gives Night  
Reception in the Daytime**

**T**HE Day-Fan Fantenna can be used with the above results on the Day-Fan Six- and Seven-tube Receivers, as well as on several other makes of well-known six- and seven-tube sets. Fantenna makes it possible to operate a six- or seven-tube receiver on an inside antenna with the same range and volume as when using an outside antenna. In congested districts, apartment houses, office buildings and similar locations where it is difficult to install an outside antenna, from 30 to 40 feet of wire placed around picture moulding or in the attic will give—when used with a Fantenna—results equal to those obtained with a sixty- to eighty-foot outside aerial. When using a normal length antenna a Fantenna changes daytime reception into the improved conditions characteristic of night reception.

Installing the Fantenna is very simple requiring as it does the connection of only three wires which are supplied with this apparatus. Operation is equally simple—Fantenna requires no tubes, consumes no current, and greatly increases (often doubling) the range and volume of your receiver. Send the coupon for full information.

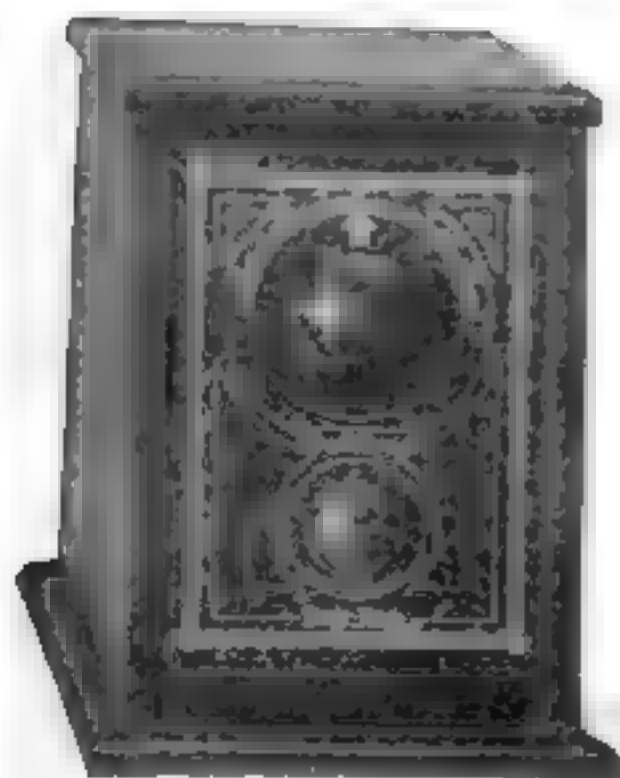
**DAY-FAN  
ELECTRIC  
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Manufacturers of Day-Fan Radio Receivers as Used by Great Broadcasting Stations; Motors and Fans.

Day-Fan Electric Co., Dayton, Ohio  
You may send me information regarding  
☐ Day-Fan Fantenna  
☐ Day-Fan Radio Receivers

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## To men who love their books!

**A**RE your books and magazines scattered about the house where they may become damaged and where the bindings may crack and break? You can easily make a book or magazine stand—and think of the fun you will get out of it. Thousands of men find wood-working an absorbing as well as a most useful hobby.

Of course you realize the importance of using good tools—the amateur user needs them even more than the professional. Nothing is more discouraging than to have a tool go wrong when you are in the midst of an interesting job. Most carpenters use Stanley Tools because they know from first-hand experience that the Stanley name stands for design, balance, and durability. And Stanley Tools are

the first choice in thousands of manual training classes.

You can buy Stanley Tools separately and so collect your own set. For your convenience in buying there are also complete sets of Stanley Tools at a wide variety of prices from \$15 to \$95. Or there are assortments in strong cardboard boxes containing directions for making your own tool chest. Price \$2.15 to \$20.

**IMPORTANT**—For only 10c (to cover cost of printing and mailing) we will send you a plan sheet which gives full directions for making a book stand like that shown above. Ask for Plan No. 11.

Ask your hardware dealer for a copy of Stanley catalogue No. 34-E. It shows the most complete line of wood-working tools on the market. If he cannot supply you write direct to The Stanley Works, New Britain, Conn.

The best tools are the cheapest to use  
Ask your hardware dealer



# STANLEY TOOLS





# The Home Workshop

Arthur Wakeling, Editor

## "Old Ironsides" in Miniature

### How to Build a Simplified Model of the Frigate CONSTITUTION

By CAPT. E. ARMITAGE McCANN

**W**HO is there with a liking for things of the sea and a desire for beautiful decorations in his home who would not take delight in owning a model of "Old Ironsides"—the most famous ship that ever carried the Stars and Stripes?

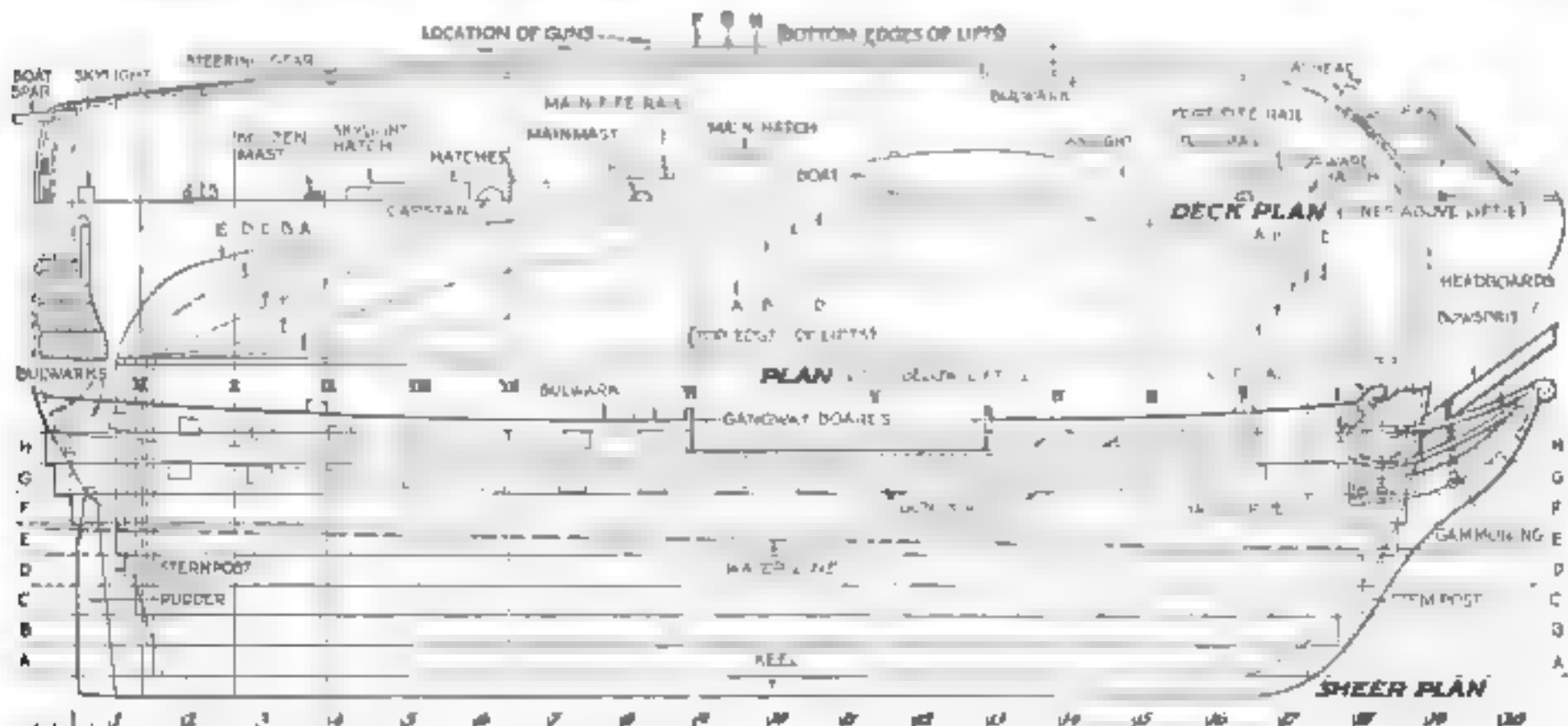
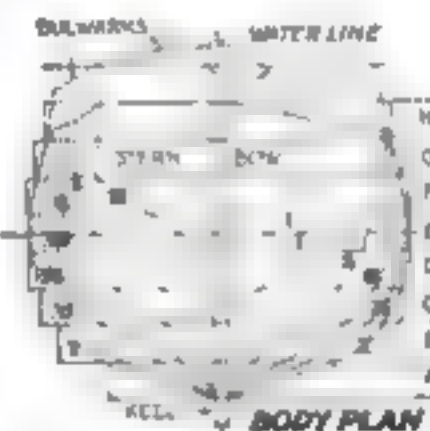
In her is embodied the spirit of the American Navy. Every school child learns her history and knows the story of her valiant battles. She not only played a monumental part in the early wars of the Republic, but she has figured gloriously in fiction, poetry and the movies. Just now she is the center of intense national interest because of the campaign conducted for funds for her restoration, which is to begin in the spring of 1927 at the Boston (Charlestown) Navy Yard.

As the history of the *Constitution* is to be found in many books and numerous articles, it will be sufficient here to say that her keel was laid down by Joshua Humphreys, of Philadelphia. She was built after the "best French practice" on the lines of a battleship, but with one deck less, making her a frigate. She was commissioned in 1798, one of the first three up-to-date warships to be built for the young Republic. She saw service in the French War, dictated peace to four of the Barbary Coast states, and won a succession of victories in the War of 1812.

She was in active commission for eighty-four years. In (Continued on page 88)



Captain McCann making the final adjustments to the rigging of his model of the *Constitution*. This represents the famous frigate substantially as she appeared during the War of 1812.



The lines of the hull, which is built up in a series of eight "lifts" on the "bread-and-butter" plan. These drawings and all other details, including

the rigging, appear full size on Popular Science Blueprints Nos. 57, 58 and 59, which can be obtained for 75 cents (see the coupon on page 85).

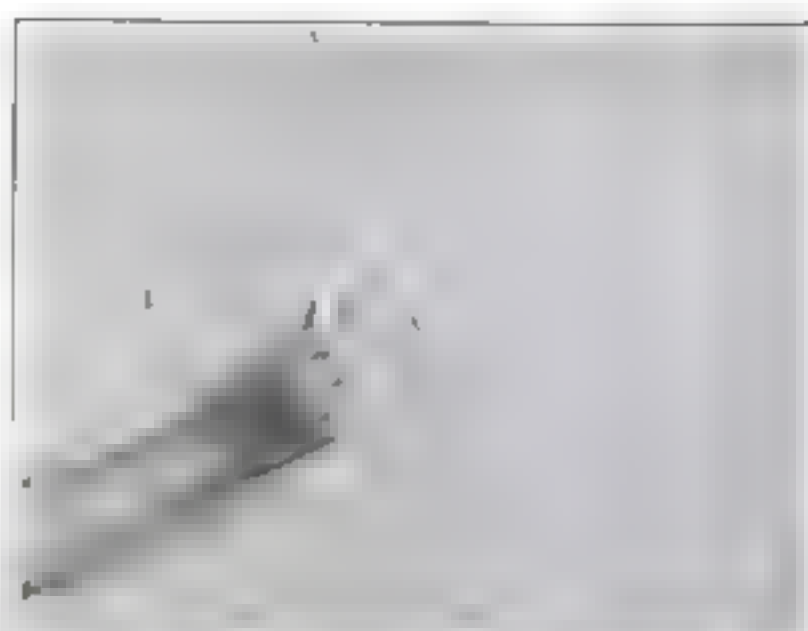
# Decorating with *Plastic Paint*

*Easy Ways for You to Do Over Old Walls and Ceilings—How to Apply Finishes in Spanish, Monastic, Italian and Colonial Styles*



Developing a Spanish texture finish. The brush is worked in a position resembling black

By  
E. M.  
OREN



The same texture is developed with a spoon. Just as the brush is worked in a position

I WAS thinking that with the living room of my house textured from the ceiling to the floor, I would be finished. She had just back from California for twenty-four hours and she started to talk about the price of covering walls that she had seen there.

"They are so lovely!" she exclaimed. Walls of almost every color, and rough texture effects beyond the possibility of counting." After a moment of silence, she went on: "Now, take that living room of ours—"

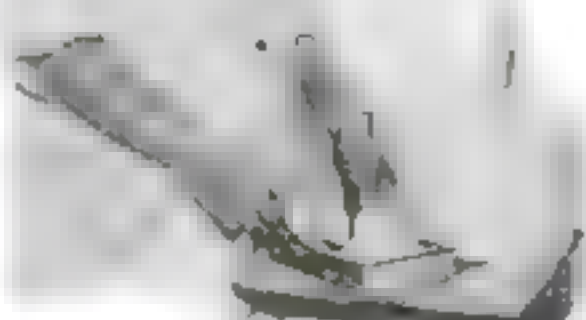
And I knew I was in for it. There could be no pleading that I didn't know now. Eleanor assured me that "Everyone says that rough-textured walls are simple to produce." She clinched it by discovering that the only house in our town that could possibly qualify as a mansion had rough-textured walls in almost every room, even the kitchen was finished in a refined stipple.

The things I discovered about color and texture possibilities through the use of plastic paint—which is to be distinguished from other paints—were a revelation. Before I was through I was developing original textures. I was doing sunburst and swirl effects and even imitating travertine marble. Instead of doing just the living room over, I went ahead and redecorated all six rooms in our house and the hallway as well. Our neighbors and guests will testify as to the effectiveness of the result.

**B**UT to begin at the beginning: I went, of course, to a paint store. Could they help me? Most certainly. And the owner told me about plastic paint.

"It comes," he said, "in the form of a white powder and all that is added to it is water and color. It is applied with a large brush and while it is still 'tacky' the texture is developed."

Long experience has taught me the wisdom of "be sure you're right, then go



Before being added to the plastic paint, the tinting color is mixed into a paste with water

ahead," so I purchased only a ten-pound package of plastic paint and went home to do a test job on a piece of wallboard I had in the basement. The paint dealer had given me a booklet, furnished by the manufacturer of the plastic paint.

**I**N PERFORMING the test I followed directions. First, I cleaned the surface thoroughly. Then I applied a coat of size. The size came in powdered form in the package with the plastic paint. As the size should be allowed to dry for six hours, I let four hours elapse before starting to mix the plastic paint. Later, when doing an entire room, twelve-quart pails were used for mixing, but for the test job I used a kitchen mixing bowl. The proportions of the mix were one pint of water to one pound of plastic paint. This gave a consistency of heavy cream.

Next I mixed the tint in a separate pan. We had decided on a buff color and a rough texture adapted from the Spanish. Dry yellow ochre was mixed with water to the consistency of a paste. Then the color was added to the plastic paint and the whole was stirred until the color was evenly distributed. The plastic paint comes out a very little lighter on the walls than in the paint and this must be allowed for.

For application I used a Dutch calumme brush and laid the material on from  $\frac{1}{8}$  to  $\frac{1}{4}$  in. thick. When it had "set up" slightly, I began the development of the Spanish texture. The tool

was a ordinary kitchen spoon and the first was to move back of the spoon across the paint in short, partially-curved strokes.

The test panel was a success. I had watched all its development and it was finished in half an hour. I was very satisfied.

or the walls and the one extra precau-

tion to be observed was that of mixing enough material to cover the entire wall area so as to eliminate any possibility of different shades of color. As we were decorating over a painted wall it was not necessary to apply a coat of size, but where the paint was scaling or loose it was scraped off. Fortunately there were no cracks. There were, however, some small crevices, and these were filled with a thick mixture of the plastic paint and then sandpapered.

Eleanor was pressed into service when it came to applying the plastic paint. It is doubtful if she could have been kept from helping, she was that interested. Alternately she took her turn with the brush or the spoon. In a few minutes over six hours the job was completed.

**F**OR the ceiling we had decided on a monastic texture, found in many old monasteries. Cream was the color chosen and yellow ochre again was used, only this time less of it. Again a test panel was made so that we could be sure of our ability to reproduce the texture before starting on the ceiling. Incidentally, this method of practicing on a panel in the way of "making sure you're right before going ahead," when it comes to plastic paint.

For reproducing the monastic texture, a 4-in. wall brush was worked in short, semicircular sweeps so that one brush-sweep crossed another or started out from it. Actually, the brushing could be called "at random"; the entire surface virtually was

(Continued on page 84)





*For Real  
FUN  
at Home  
Play  
Billiards*

## \$26<sup>50</sup> Brings This Wonderful Billiard Table to Your Home

**T**HINK of it! A genuine standard type, slate bed billiard table—a table with accurate angles, junior regulation cushions, fully equipped, beautifully constructed and finished, for \$26.50 cash—with the balance in small monthly payments.

Picture the fun you could have those long winter evenings with a real billiard table in the house—the thrill, the interest, excitement with a billiard tournament in progress every night.

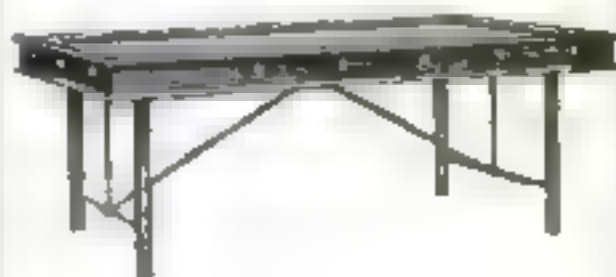
Family, neighbors, friends—everyone can play and there isn't a better, more wholesome form of entertainment a home could offer. And it is good exercise.

This remarkable Brunswick table, the "Playmate" isn't a toy. It is a modified standard slate bed billiard table. Real the best you can get at the right. Then fill out and mail the attached coupon for full details, prices, etc. Do it today.

**THE BRUNSWICK-BALKE-COLLENDER COMPANY**  
*Established 1845. Branches in All Principal Cities in U. S. and Canada*

*Play  
Billiards*

### *The "PLAYMATE"*



A modified standard billiard table, size 3<sup>1</sup>/<sub>2</sub> x 7 ft., with folding legs, genuine slate bed to assure an absolutely level playing surface, cushions, balls and angles scaled to scientific proportions providing all the playing qualities of a regular professional size table.

The Playmate is designed especially for small homes where extra space or a special room is not available. It comes completely equipped—ready for play.

**Price \$26<sup>50</sup> Cash**

*Balance in small monthly payments*

At a slight extra cost interchangeable cushions may be had making the table suitable for either carom or pocket billiards. Smaller tables for pocket billiards only, sizes 2<sup>1</sup>/<sub>2</sub> x 5 ft. and 3 x 6 ft., may be had at still lower prices.

The Brunswick-Balke-Collender Company  
Dept. H-183, 625 S. Wabash Ave., Chicago, Ill.

Gentlemen: Please send me full descriptions, prices and terms on Brunswick Home Billiard Tables.

Name

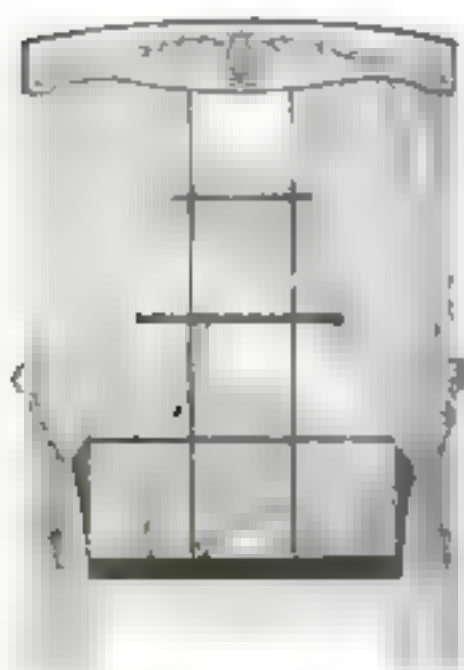
Street

City

# Valance Boards for Your Windows

## How to Cut and Decorate Them—Colonial and Modern Designs—Color Schemes

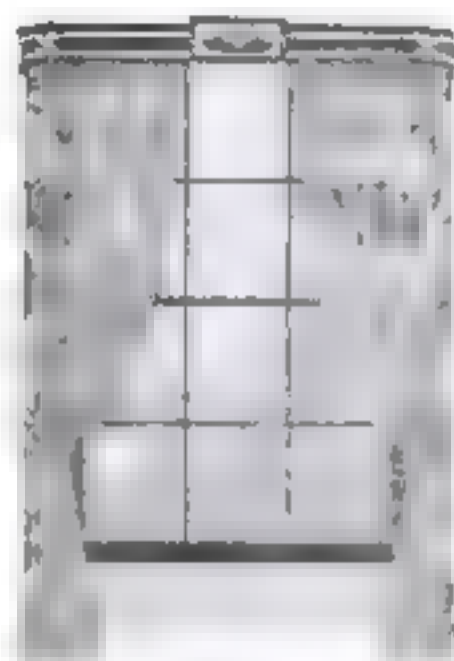
By MARIE CHILDS TODD



A graceful painted board, in the early American character



A long valance board made by one of Miss Todd's high school pupils. It is painted in Chinese red with a dragon in green gold



Curved corners are the distinguishing feature of this design

**V**ALANCE boards across the tops of the windows often will give a room just that touch of distinction necessary to raise it above the common place.

The advantage of a wooden or wall board valance is that it is easily cleaned, the colors may be retouched, and it outwears a textile valance. It also conceals unsightly curtain rods.

The accompanying sketches will suggest ways of varying the designs of any valances you make so that they will express your own taste in line, mass, and color and give the individuality that is of paramount importance in all matters of home decoration.

These valances are just as effective in houses and apartments in our country today as they were in the Colonial mansions of the early Eighteenth Century. One of the most charming customs was the use of painted valances for windows and for four-poster beds.

A bedroom that I saw in an exhibition of original Eighteenth Century furnishings had very graceful, colorful wooden valances for the windows and also a four-poster bed valance to match. The color scheme was rose and gray-blue and yellow on an old ivory background tone. Music was the motif, or idea, for the center design of the window valances—an oblong medallion formed of a group of three musical instruments combined with an open book of music. The end boards of the valances, which were fastened against the wall at either side of the windows, were made with graceful curved surfaces. The window and four-poster bed draperies were of black-printed muslin in a light and dark crimson on an ivory white background similar to the very popular *toile de Jouy* hand-printed cloth.

**T**HE valance boards give the crowning touch of elegance to our modern rooms and heighten the charm and color of window draperies, whether used in living rooms, bedrooms, dining rooms, or breakfast rooms.

A wooden valance does not need to be exactly the color of the woodwork of a room, but its background tone should



Flower basket design, ship motif in relief, green work, and a textile covered valance

harmonize either with the drapery color scheme or with the walls.

First find the exact over-all width of your windows. To this add  $1\frac{1}{2}$  in. to allow  $\frac{3}{4}$  in. on each end for the bracket or end pieces, which are screwed against the outside of the casing. (See the illustration on page 78.) These valances are usually about 9 in. deep. When more than one valance board from the same pattern is required, always start with the broadest window and diminish the pattern for the smaller windows.

Woods that are good for these valances

are white pine, gum, yellow poplar, maple and birch. Thoroughly seasoned and kiln dried stock should be obtained from a lumber company or your carpenter or cabinetmaker. White pine is especially good for staining in an antique tone and waxing—it is a wood much associated with Colonial interiors.

Fiber wallboard is readily adaptable to the making of window valances or cornices and has the advantage of being light and very easy to cut. The edges must be sandpapered and treated with shellac to insure a neat appearance when finished.

Cut one board first to be sure you are working correctly. If you care to pay a local carpenter or a lumber mill to cut your first valance boards, it will seem a very simple matter. Have your design clearly drawn in outline on a large sheet of wrapping paper.

The tools necessary, if you do your own work and use wood, are a keyhole or compass saw (or a turning saw), an ordinary hand saw, a small plane, a rasp or wood file and plenty of sandpaper.

A spokeshave also is an aid for smoothing curves, and often several large sized auger bits or an expansive bit can be used to advantage.

Cut your board first in a rectangular shape the length and depth desired. It is a good plan to allow about  $\frac{1}{2}$  in. extra all around for planing and sandpapering.

**F**IND the center of your board and place the pattern on the center line. Working toward the right-hand end, thumb-tack your pattern to the board and trace it carefully. Then remove your pattern, reverse it and mark the other half of the board.

In sawing keep about  $\frac{1}{8}$  in. outside the outline. Use a wood file or spokeshave to remove the rough edges and finish with sandpaper.

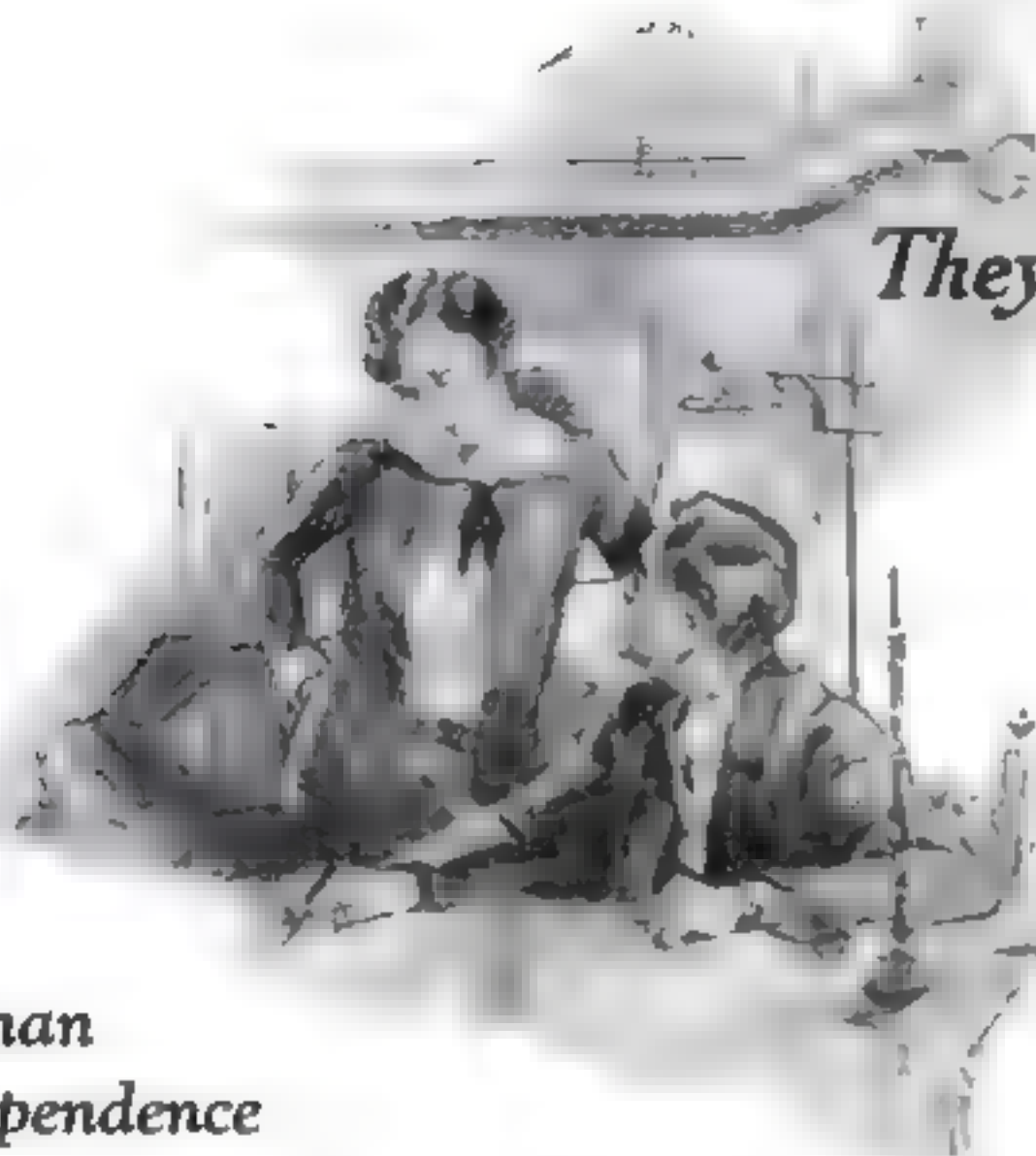
Two end pieces are required for each valance board, these usually are 4 in. in depth. These are (Continued on page 78.)



Both valance and draperies in this charming room match in their background color

Turn to page 74 for the continuation of the Home Workshop Department.





## Good Pay, but - They are Not Getting Ahead

### Human Independence as worked out by a 63-year old Organization

**H**OW blindly do some people go along barely fighting off expenses! And yet how narrowly they miss a competence, miss independence. Capable and industrious, they occupy positions for which they are not suited and struggle against conditions which weigh them down.

Such a practical organization as the Brotherhood of Locomotive Engineers, whose financial operations extend from coast to coast, has for more than sixty years made a study of living and working conditions with a view to solving the problems of just such people as these.

If your earnings, though good, fail to yield a real margin above expenses, you can well investigate what the Brotherhood is doing on its farms at Venice on the Gulf, to provide a substantial basis of financial independence for families or a newer, freer life, in Florida's health-giving air and sunshine.

Venice Farms, in tracts from five acres up, offer a great variety of speed-profit crops, three or four a year if you like—which reach markets ten to sixty days earlier than other sections, and thus command highest prices.

Behind every Venice farmer stands the Venice Farm Board prepared to render helpful, intelligent field advice and service. The farms are sold by the Board, at moderate prices on liberal terms, with the land cleared and ready to plant. Near at hand are the facilities of the Venice Demonstration Farm, the Venice Nursery and the Venice Dairy Farms.

### Their Problem solved by this Rational Worryless New Life

**T**HESE hurried people under this combination of best working and living conditions, can make a moderate savings account lead to real independence... It is possible to make one of these farms pay for itself in a few years. Add year round outdoor life, a summer climate the whole year and an attractive location on the beautiful Gulf and next to one of the finest of modern cities.

### Venice a Natural All-Year Resort

Venice life is divided between agriculture, industry and resort activities. Vacationists remark the variety of diversions. Here one finds the West Coast's only mainland beach and its most famous fishing grounds. Here is a modern city planned and built by experts, which fronts on the beach. Adjacent to it is the largest and most comprehensive farm development ever projected in America.

Venice hotels, with fixed rates at \$5 to \$15, and plenty of rooms at \$5, serve fruit, vegetables, milk and cream received fresh each day from Venice Farms nearby. Conveniently located are well kept golf courses, tennis courts, quonset and other games, and excellent hunting and fishing are found on the tropical Myakka River.

[We find this advertising to be demonstrable facts supplied by the Venice Farm Board and officials in charge of the City of Venice.]

#### THE VENICE COMPANY

Owned by The Brotherhood of Locomotive Engineers

Mail this coupon for the illustrated booklet containing information and photographs supplied by the Venice Farm Board, and receive this year, securing the opportunity to lead a new free life under ideal conditions at Venice on the Gulf.

**THE VENICE COMPANY**  
113 Venice Boulevard, Venice, Florida

Please send me the booklet containing information and photographs supplied by the Venice Farm Board and Broker Office, describing "A New Life of Independence" possible under the pleasant conditions at Venice.

Name \_\_\_\_\_

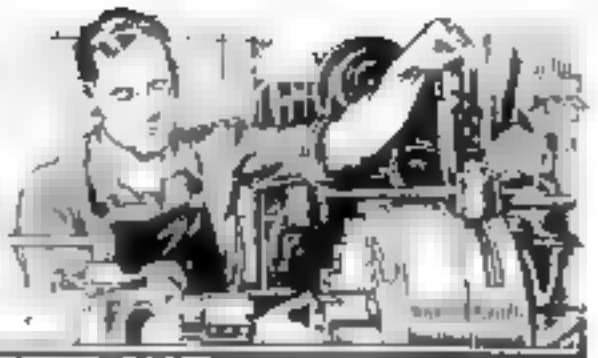
Address \_\_\_\_\_

Present Occupation \_\_\_\_\_

## VENICE FLORIDA

# Better Shop Methods

*How Expert Mechanics Save Time and Labor*



## Secrets of Successful Boring

*How to Sharpen Tools for Use on Scale-Coated Cast Iron and Bronze—  
Roughing and Finishing—The Best Shape for Cutting Steel and Aluminum*

"WHAT I'd like to know is whether there is any kind of a tool that will stand up long enough to bore these bushings!" Harvey exclaimed in disgust as he removed a boring tool from the lathe tool post and walked over to the grinder.

Eight bronze bushings like A in Fig. 1 were to be bored and reamed and Harvey was using an ordinary forged boring tool, B.

Mr. Grimes, the efficiency engineer, happened along just as Harvey was resetting the tool and inquired how things were going.

"All right except that I'm having some trouble keeping this tool sharp," the young machinist responded. "This bronze scale is fierce! It takes the edge right off the tools."

"Bronze scale is always bad, Harvey, but it seems to me that I wouldn't do the job just that way if I were doing it."

"Why, what's wrong?"

"Nothing really bad, but I believe your method could be improved. In the first place I wouldn't grind the tool as you have it (A in Fig. 2). I'd give it this shape."

The engineer sketched the tool B (Fig. 2) on his always handy memo pad.

"But I always thought a round-nose tool was better for boring," objected Harvey.

"That isn't always true. It depends upon conditions. Have you stopped to think what causes your round-nose tool to get dull so quickly?"

"It's the scale, isn't it?"

"UNDOUBTEDLY. But you can easily see that a round-nose tool will tend to ride up on the scale while one ground as at B gets under it. Let's grind another tool giving it about five degrees back angle and see what happens."

Harvey ground a tool as directed and put it back in the holder again.

"Now, don't use too much feed," cautioned Grimes; "not over five thousandths per revolution."

Much to Harvey's surprise, the tool bored completely through the piece without growing dull. It appeared keen enough for the finishing cut, so he started the cut and, turning to Grimes, remarked "That scheme works fine, but it doesn't give as smooth a hole as

By ALBERT A. DOWD

*Consulting Engineer*

the round nose tool. That isn't so good."

"That's true," admitted the engineer, "but the reamer will give you just as good a hole as before, and that's what you are looking for."

"Let me ask you something else, Mr. Grimes. Should a boring tool be set on

ute," the older man said. "If the tool is set on center as at A, the tool springs downward under a heavy cut and digs into the work. If the tool is below center, the same thing happens and the tool digs in still more. Now look at this sketch (B), in which the tool is set above center. When the tool springs downward, it is thrown away from the work, so it doesn't chatter."

"Then some of the other fellows in the shop are dead wrong, Mr. Grimes. I see the principle of it now, of course the tool should be above center."

"The important things in boring, Harvey, are the shape of the tool and its position. For work that has been drilled first, the shape of the tool is not so important, but for working in any kind of a cored hole, the tool should be carefully shaped so it will not ride upon the scale."

"What about flat cutters for boring? Do they give as good results as single point tools?"

"That depends on the work," Grimes answered. "Here is a flat cutter bar (A, Fig. 4) both ends cutting at B and C. This kind of a bar is very good when concentricity is not of importance, but it is not strictly a generating tool as it has two cutting points opposite each other. In reality the cutting action is more nearly like a drill, not to be depended on for a cored hole. This type sometimes can be used to advantage for rough boring, but it should always be followed by a single point boring tool in order to generate a true hole."

HARVEY next suggested that what he should like to know most of all was what kind of boring tools to use for cast iron, bronze, steel, alloys and aluminum and what is the difference between them in respect to cutting action.

"If you'll tell me those things, I'll be happy," he added hopefully.

Grimes laughed.

"You don't want much, do you? I will give you a few interesting points to watch out for anyway, even if I..."

*(Continued on page 108.)*



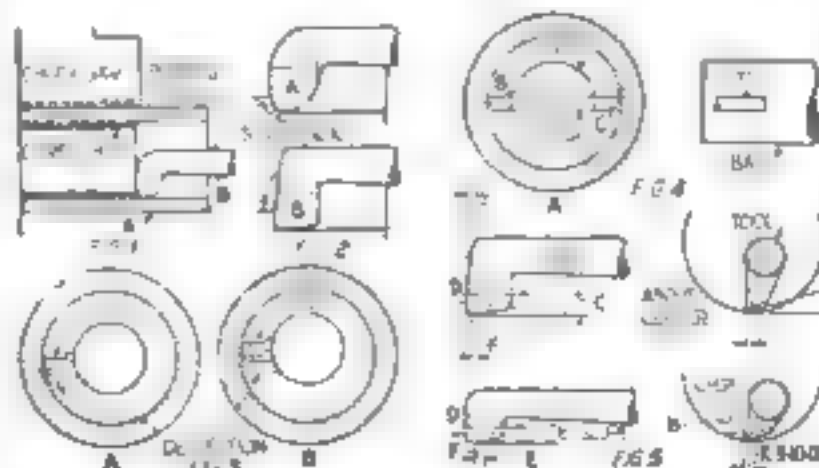
"I'm having some trouble keeping this boring tool sharp," said Harvey. "The bronze scale is fierce!"

center or not? Some of the men say it cuts better a little below.

"You come up to the house tonight and I'll tell you and give you a few other pointers about boring tools. We can't talk about it while you are busy on that job—you've got your hands full."

So that evening Harvey appeared with his note book, now pretty well filled with notes on machine shop practice. He reminded Mr. Grimes of his question about the position of a boring tool.

"Look at this diagram (Fig. 3) a mini-



The principles involved in grinding boring tools and setting them in relation to the center of the work

MANY time-saving shop ideas are contained in the continuation of the Better Shop Methods Department, on pages 104 to 110.





**here's the  
trick for  
close quarters—**

The No. 151 Starrett Hacksaw Frame. Take a good look at it—and then think of all the tight corners you've tried to use a hacksaw in. For repair jobs on the car—getting at fender and body bolts, Ford bands, etc.—around the radio set, odd jobs of pruning and—well, there's a whole flock of odd jobs of cutting around the average home for which this frame is just the trick.

Ask your hardware dealer to show you the No. 151. And write us for descriptive matter and a free copy of Catalog No. 23 "W."

**THE L. S. STARRETT CO.**

*World's Greatest Toolmakers  
Manufacturers of Hacksaws Unexcelled  
Steel Tapes—Standard for Accuracy  
ATHOL, MASS.*



363

# Use Starrett Tools



PEXTO  
HAMMER  
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EVERYWHERE about the home—from cellar to attic, from kitchen to garage—you will find need of a good Hammer.

There is a style Hammer in the extensive Pexto line to meet your requirements—ask your dealer to show them to you—thirty styles in all and all practical sizes of each style. They are drop forged steel, carefully finished and properly hardened.

All Pexto Tools are backed by a century of tool making experience. The line consists of Bit Braces, Hammers, Chisels, Screw Drivers, Hatchets, Snips, Squares, Wrenches, Pliers, and many other small tools and it is easy to procure Pexto Tools as they are carried by practically all progressive dealers.

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The Peck, Stow & Wilcox Co.  
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PEXTO

Worth While  
TOOLS



## Easy Ways to Build Four Styles of Decorative Hanging Bookracks

By HERMAN HJORTH

HANGING bookracks are enjoying a renaissance of popularity. Interior decorators and those who set the fashions in furniture have given their approval to these decorative and most useful pieces.

Sets of books, novels, magazines and other forms of printed matter accumulate with such amazing rapidity that the family bookcase is overflowing and the good housewife distracted with the problem of how to take care of the surplus and still keep the home looking tidy, especially when space and cupboard room are at a premium.

The four bookracks illustrated herewith should, therefore, be welcome additions to the furnishings of almost any household, because they provide more book space in the home without encroaching upon the space needed for other pieces of furniture. They are designed to hang over a desk, on a pillar between two windows, in a cozy corner, or on any convenient wall space. They are simple of construction and inexpensive.

Before actually beginning the construction of any one of them, however, the author earnestly recommends each interested reader to measure the wall space available for such a

bookrack, as well as the books to be placed on its shelves. Books vary so much in size that it is quite possible that the designs submitted may have to be changed a little to meet individual needs.

The bookrack illustrated in Fig. 1 is the simplest in construction; it consists only of two sides and three shelves. First

plane these five pieces of lumber to the finished dimensions given in the stock bill on page 76. Lay out the dados very carefully on both the side pieces, clamp them to the bench, and cut the outline by using a sharp 1 in. chisel and striking it lightly with a mallet (Fig. 1, A). Cut a groove as shown at B and saw down to the gage line with a backsaw (C). Re-



Hanging bookracks like this are charming pieces when well designed and constructed

move the waste wood with a router plane or a 1/4 in. chisel. Cut the other dados in the same way and give them all a light final cut without changing the setting of the router plane, so that they will all be of the same depth.

This work must be done very accurately so that the shelves will fit tightly. Note that the dados are not cut all the way across the sides, but stop about 1/4 in. from the front edge. See the isometric sketches in Figs. 1 and 4 and the sections at the front.

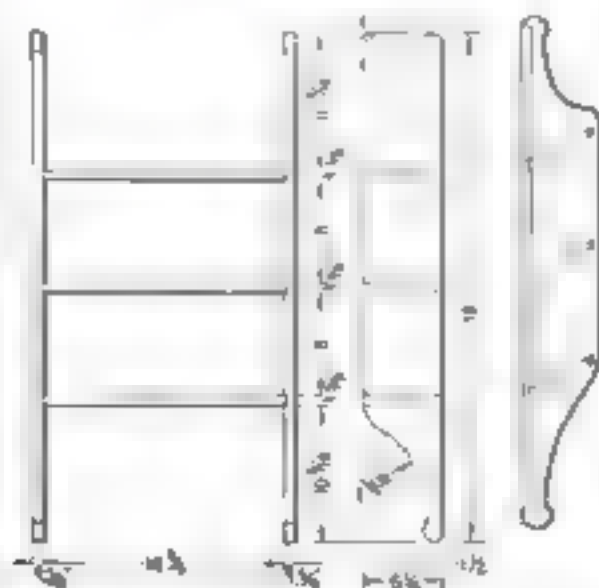
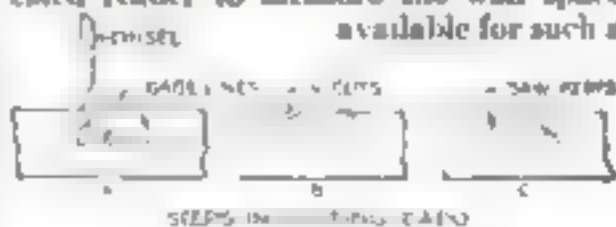


Fig. 1 The simplest type of hanging bookshelves. Only five pieces are required

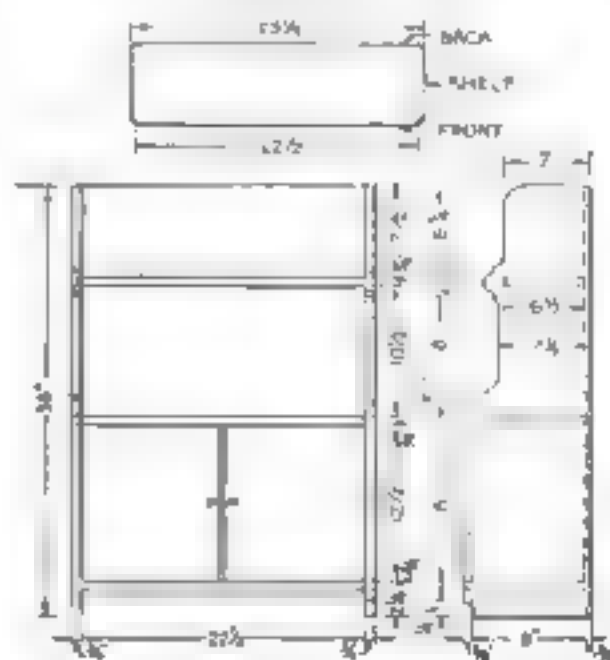
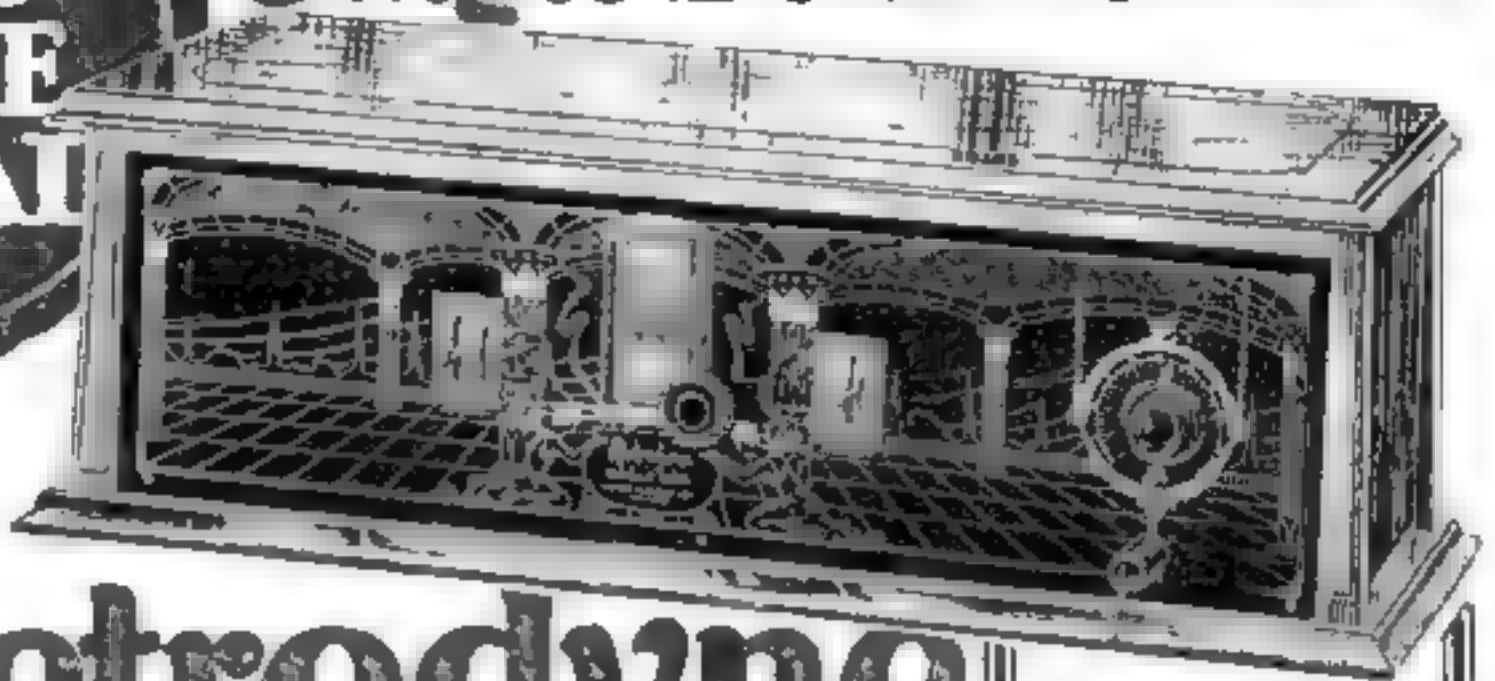


Fig. 2 In this cabinet doors conceal a compartment for magazines and odd papers



**30  
DAYS  
FREE  
TRIAL**

# 7 Tube Set Single Dial Radio



## The Metrodyne

**ONLY ONE DIAL TO TUNE**

### Wonderful Offer Direct from the Factory!

A perfect working single dial control. 7 tube receiver. And just to prove our claims, we will ship it to your home for **30 days' free trial**. Test it under all conditions. Test it to distance volume and tonal quality — and if you are not convinced that it is the best single dial set you ever heard, return it to the factory. We don't want your money unless you are completely satisfied.

**Retail Price**

**\$75**

**Completely Assembled**

**Big Discounts  
to Agents and Dealers**

#### BIG PROFITS

#### TO AGENTS AND DEALERS

Our Agents and Dealers make big money selling Metrodyne Sets. You can work all or part time. Demonstrate the superiority of Metrodynes right in your home. Metrodyne Radios have no competition. Lowest wholesale prices. Demonstrating set on 30 days' free trial. Greatest money-making opportunity. Send coupon below—or a letter—for our agent's proposition.

## Metrodyne Super-Seven Radio

A single dial control, 7 tube, tuned radio frequency set. Approved by America's leading radio engineers. Designed and built by radio experts. Only the highest quality low loss parts are used. Magnificent, two-tone walnut cabinet. Artistically gilded genuine Bakelite panel, pickered piano hinge and cover support. All exposed metal parts are beautifully finished in 24-k gold.

An easy set to operate. Only one small knob tunes in all stations. The dial is electrically lighted so that you can log stations in the dark. The volume control regulates the reception from a faint whisper to thunderous volume, 1,000 to 3,000 miles on loud speaker! The Metrodyne Super-Seven is a beautiful and efficient receiver, and we are so sure that you will be delighted with it that we make this liberal **30 days' free trial offer**. You to be the judge.

### Mail COUPON Below!

**Let us send you proof of  
Metrodyne quality**

F. L. Warnock, Grinstead, Ind., writes: "I received the Metrodyne 7 tube set and am more than pleased with it. Got stations 2,000 miles away."

C. J. Walker, Maricopa, Calif., writes: "Received my Metrodyne 7 tube set and K 3 tubes. Just first-class set and very easy to be excited. I had no trouble in tuning in a station enough to satisfy anyone, so you will please send me another set."

Rev. Bishop, San Francisco, Calif., writes: "Very often we travel in New York to the Islands quickly—four or five times in the means of the set in tuning knob which is very electrically lighted dial. The Metrodyne 7 tube set is much easier to operate than any radio set I have ever had."

We will send you hundreds of similar letters from owners who acclaim the Metrodyne as the greatest radio set in the world. A postal letter or the coupon brings complete information, testimonials, wholesale prices, and our liberal **30 days' free trial offer**.

#### METRO ELECTRIC COMPANY

2161-71 N. California Ave., Dept. 151  
Chicago, Illinois

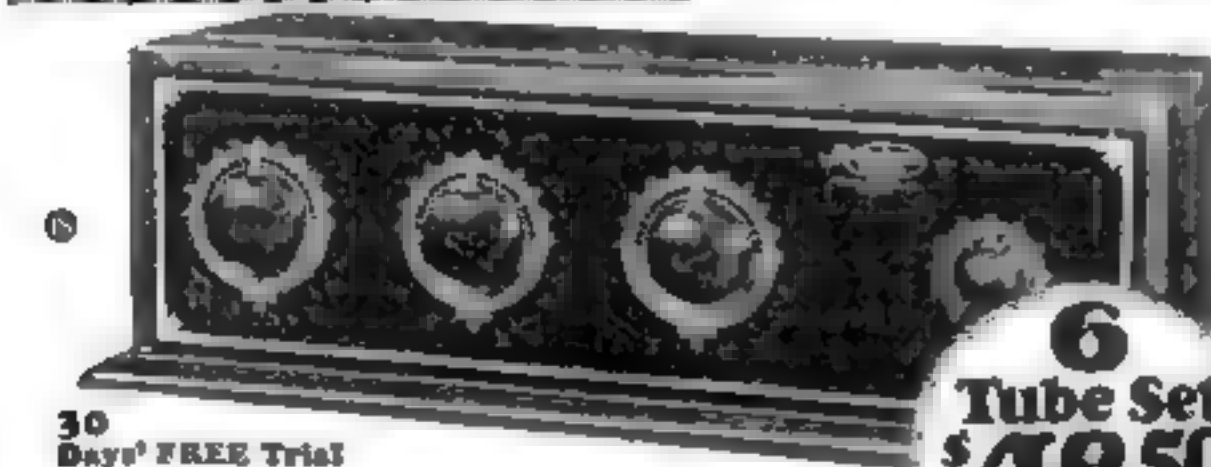
Gentlemen:

Send me full particulars about Metrodyne 6 tube and 7 tube sets and your **30 days' free trial offer**

Name \_\_\_\_\_

Address \_\_\_\_\_

If you are interested in AGENT'S proposition place an "X" in the square ☐



**30  
Days' FREE Trial**

## Metrodyne Super-Six

Another triumph in radio. Here's the new 19.7 model Metrodyne 6 tube set. It is a masterpiece of engineering and design. Proved by leading radio engineers. America's leading radio engineers have built it to last. It is a masterpiece of engineering and design. Easy to operate. The tuning knob is so simple that you can tune in any station instantly on some dial readings every time. No guessing.

Mr. Howard, of Chicago, sold: "While five Chicago broadcasting stations were on the air I tuned in seventeen out-of-town stations including New York and San Francisco, on my loud speaker horn, very loud and clear as though they were in Chicago."

We are one of the pioneers of radio. The success of Metrodyne sets is due to our liberal **30 days' free trial offer**, which gives you the opportunity of trying before buying.

**6  
Tube Set  
\$48.50**

**RETAIL PRICE**

**Completely  
Assembled**

**MAIL THIS  
COUPON**

or send a postal or letter. Get our proposition before buying a radio. Deal direct with manufacturer—**Save Money.**

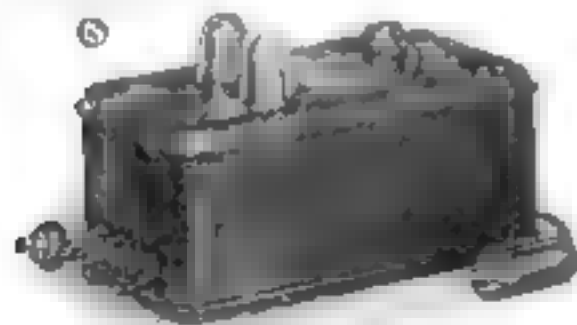
**METRO ELECTRIC COMPANY**

2161-71 N. California Ave. • Dept. 151 • Chicago, Illinois

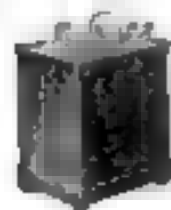


**THE Aero B Amplipower** can actually turn your radio set into a true musical instrument. When used with a good loud speaker it will reproduce every shading of tone, both vocal and instrumental. Low D on the bass viol booms out just like the original and high C is actually high C. With an Amplipower—voices are really human—not merely boxed-up reproductions.

The Aero B Amplipower not only makes possible the maximum in tonal quality and volume, but also supplies all of the "B" current for the radio set. Simply attach it to any set the same as a "B" battery, remove the last audio tube of the set and insert the Amplipower adapter and the Amplipower is ready for service.



The Amplipower will give you music that you never before heard on your radio—music that is music, with every note as rich and full as the original. Price \$65.00 without tubes. If your dealer hasn't Amplipower or Aero B, write us, giving his name.



Aero B is also built as a "B" power unit without the high voltage power tube—price \$35.00 complete.

THE GLENN L. MARTIN COMPANY  
Radio Division Cleveland, Ohio



## Decorative Hanging Bookracks

(Continued from page 75)

corners of the shelves in Fig. 2. This type of joint is called a "gum" joint.

The curves are now laid out on the outside of one of the sides according to the drawing and the two sides nailed together and cut at the same time. The nails, of course, should be driven in the part to be cut away so as not to mar the finished surfaces. If a band saw is not available,

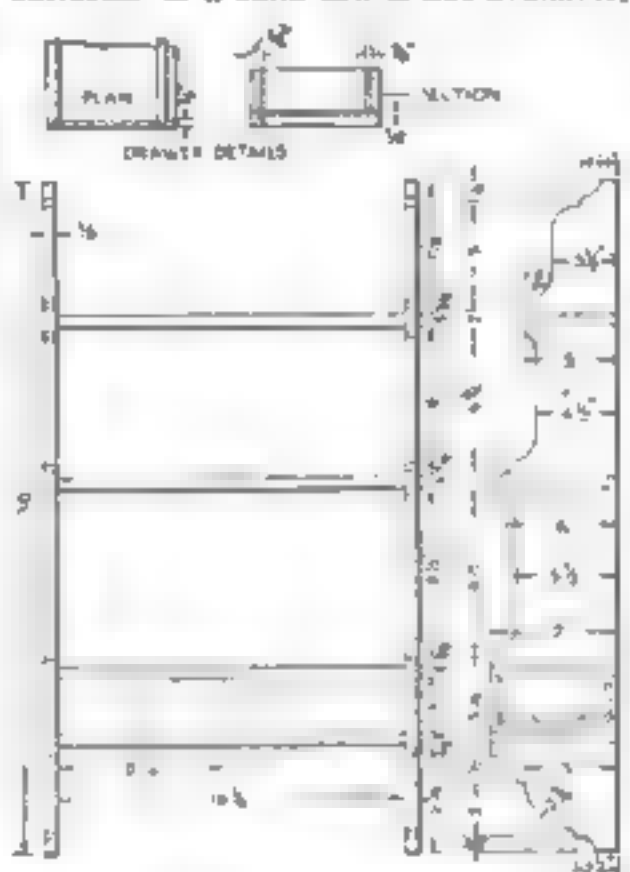


Fig. 3. A more ornamental type with small drawers fitted between the lower two shelves.

the curves can be cut with a turning saw or a coping saw. Clamp the two pieces together and finish the curves with spoke-shave, chisel, scraper, file, and sandpaper, being careful not to round the edges with the sandpaper. The shelves and sides are given a final scraping and sandpapering and the rack is then ready for gluing.

This must be done, for best results, in a warm room and both the glue and the wood must be warm. Use two clamps to each shelf and put blocks between the clamps and the finished surfaces so as not to mar them. Test for squareness with a try-square and wash off any surplus glue with hot water immediately after gluing and clamping. Leave the clamps on overnight. If no clamps are available it is easy to make some from waste lumber as shown in Fig. 6.

The bookrack, Fig. 2, is made in the same manner. After it is glued, doors are fitted in between the lower two shelves, so that magazines, papers, or other unsightly written matter may be kept there. Three ways of finishing the doors are shown. The first (A) is rather difficult to do without machinery. The second (B) shows a piece of wood glued to the edge of the right-hand door, and the third (C) shows a bead cut on the edge of each door. Such a bead may be formed with the aid

### Stock Bill for Bookracks

No.	Part	T	W	L	Part
1	Side	1	6 1/2	30	For Fig. 1
2	Shelf	1	6 1/2	30 1/2	Shelves
3	Side	2	10	25	For Fig. 2
4	Shelf	2	9 1/2	23 1/2	Shelves
5	Side	2	8 1/2	22 1/2	Shelves
6	Shelf	2	23 1/2	3 1/2	For Fig. 3
7	Side	2	11 1/2	1 1/2	Shelves
8	Shelf	2	11 1/2	1 1/2	Shelves
9	Side	2	11 1/2	1 1/2	Shelves
10	Shelf	2	11 1/2	1 1/2	Shelves
11	Side	2	11 1/2	1 1/2	Shelves
12	Shelf	2	11 1/2	1 1/2	Shelves
13	Side	2	11 1/2	1 1/2	Shelves
14	Shelf	2	11 1/2	1 1/2	Shelves
15	Side	2	11 1/2	1 1/2	Shelves
16	Shelf	2	11 1/2	1 1/2	Shelves
17	Side	2	11 1/2	1 1/2	Shelves
18	Shelf	2	11 1/2	1 1/2	Shelves
19	Side	2	11 1/2	1 1/2	Shelves
20	Shelf	2	11 1/2	1 1/2	Shelves
21	Side	2	11 1/2	1 1/2	Shelves
22	Shelf	2	11 1/2	1 1/2	Shelves
23	Side	2	11 1/2	1 1/2	Shelves
24	Shelf	2	11 1/2	1 1/2	Shelves
25	Side	2	11 1/2	1 1/2	Shelves
26	Shelf	2	11 1/2	1 1/2	Shelves
27	Side	2	11 1/2	1 1/2	Shelves
28	Shelf	2	11 1/2	1 1/2	Shelves
29	Side	2	11 1/2	1 1/2	Shelves
30	Shelf	2	11 1/2	1 1/2	Shelves

All dimensions are in inches.

of a marking gage and a piece of sandpaper. The spur of the marking gage should be sharpened so that it will cut a rather wide line or groove, after which the edges are rounded with the sandpaper.

The doors may be kept shut by means of ball catches let into the lower edges of each. If it is desired to lock the doors, a lock should be put on the right-hand door and a small bush bolt on the left-hand one.

A back may be fastened to the shelves after the bookrack is finished. A rabbet 1/4 by 3/4 in. must be cut for it, however, on the inside rear edges of the sides before the bookcase is glued up. The back may extend to the bottom of the case or stop behind the lower shelf. If a back is not desired, the

(Continued on page 81)

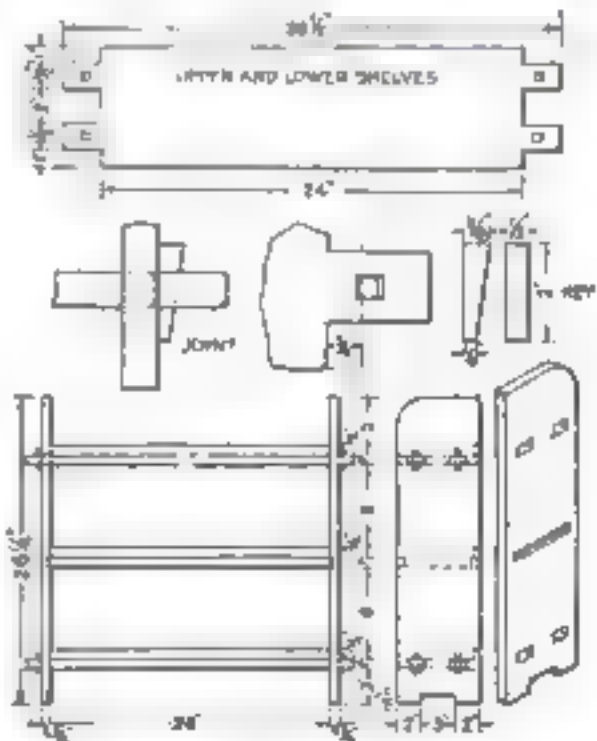


Fig. 4. A bookrack which comes apart so that it can be packed flat for shipment.



APPROVED BY 18 MONTHS OF PUBLIC USE  
NO OTHER BATTERY IS LIKE IT



The Layerbilt  
No. 486  
is the  
most  
economical  
and  
reliable  
"B"  
battery  
ever  
built.

Eveready  
Layerbilt  
No. 486  
is the  
most  
economical  
and  
reliable  
"B"  
battery  
ever  
built.

## Practical tests show this to be the most economical type of "B" Battery

IN DAILY use in the home, Eveready Layerbilt "B" Battery No. 486 has fulfilled the promises made for it in laboratory tests. After more than a year's study of the performance of this battery in the hands of the public, we believe confidently that it is the most satisfactory and most economical "B" battery ever developed. All loud-speaker sets require Heavy-Duty batteries.

If you are now using the smaller, Light-Duty batteries, the Eveready Layerbilts will give you twice the service though they do not cost anything like twice as much. If you are already using Heavy-Duties, the Layerbilt, the longest lasting Heavy-Duty ever built, will run your set at least 25% longer, and again you will save money. Unless Eveready Layerbilts now are connected to your set, you spend more on "B" batteries than you should, and

you can have no idea how good a "B" battery can be. The Layerbilt holds a surprise in store for you.

Eveready Layerbilt's unequalled service is due to its unique construction. All other dry cell "B" batteries are made of cylindrical cells, with many soldered connections, and a great deal of space is wasted between the cells. The Layerbilt is built up of layers of flat current-producing elements, that make connection with each other automatically, and that fill all available space inside the battery case. It is every inch a battery.

In it you get more active materials than in any other battery and the Layerbilt construction makes those materials much more efficient current producers.

Those are the convincing reasons why the Eveready Layerbilt has proved itself the longest lasting,

most economical and reliable "B" battery ever built.

Just remember this about "B" batteries — Heavy-Duty batteries are more economical than the smaller Light-Duty batteries on all loud-speaker sets and the patented exclusive Eveready Layerbilt No. 486 is the most economical Eveready battery ever built.

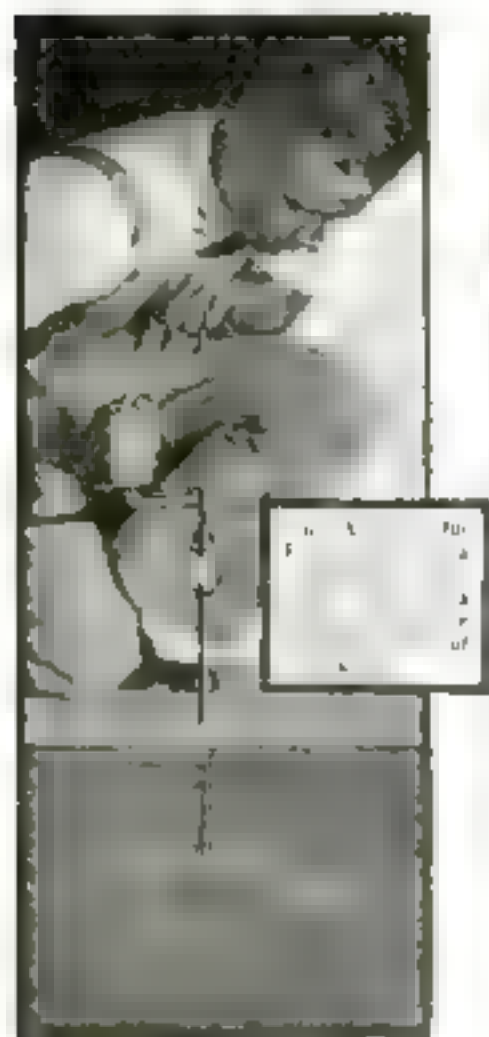
Manufactured and guaranteed by  
**NATIONAL CARBON CO., Inc.**  
New York San Francisco

Canada: National Carbon Co., Limited  
Toronto, Ontario

Tuesday night is Eveready Hour Night—8 P. M., Eastern Standard Time, through the following stations:

WEAF—New York	WTAM—Cleveland
WJAR—Providence	WWJ—Detroit
WEEI—Boston	WCAE—Chicago
WTAG—Newcastle	WOC—Dayton
WFI—Philadelphia	WCCO—Minneapolis
WGB—Buffalo	WOL—St. Paul
WCAE—Pittsburgh	KMO—St. Louis
WMA—Cincinnati	WNC—Washington

## Stands abuse and follows through



**"YANKEE" Bit Extension is new!** Bit held by socket. No jaws to break. No loosening and pulling out of bit in work. No trouble to "follow through." And bit in "Yankee" Socket can't jam.

## "YANKEE" No. 2150 Bit Extension

Lengths 16, 18, 21, 24 in.  
Full nickel-plate finish.  
Holds large range of bit shanks.

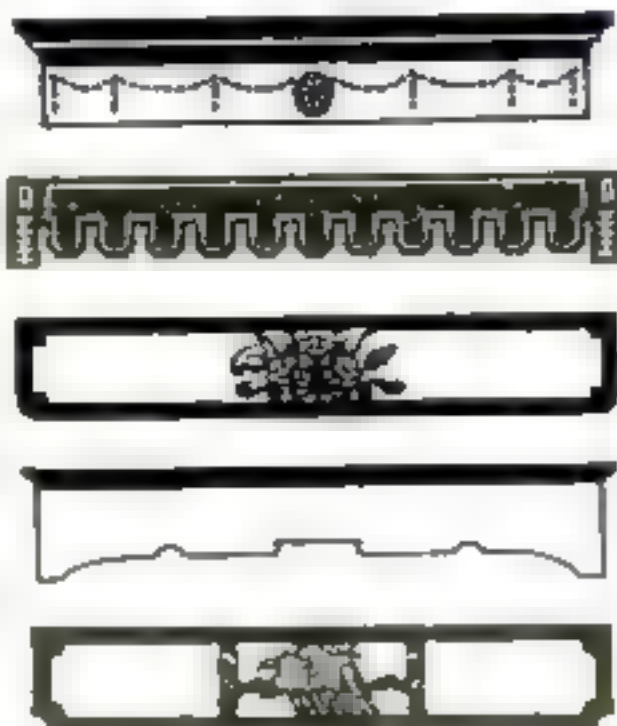
Ask your hardware dealer to show you this new "Yankee" Tool for saving time and labor. Write us for free "Yankee" Tool Book.

NORTH BROS. MFG. CO.  
Philadelphia, U. S. A.

**"YANKEE" TOOLS**  
Make Better Mechanics

## Valance Boards for Windows

(Continued from page 70)



Five more valances that suggest the many ways in which designs may be developed

nated or screwed to each end of the valance boards and the whole is then ready to be screwed to the upper outside trim of the window after finishing. A rod for curtains may be screwed to the inside of the rod pieces 2 in. above the lower edge.

The long valance board shown in the central illustration at the top of page 70 was made by a young man for a group of three windows in his mother's breakfast room. He used clear shellac on the board first. Then he transferred a dragon design in pencil and applied gesso to raise the ornament  $\frac{1}{4}$  in. above the background. The process of using gesso was well described in the April, 1926, issue of *POPULAR SCIENCE MONTHLY*.

The young man then painted the valance with Chinese red brushing lacquer, two coats being applied. Finally he went over the gesso with green gold outlined in black. The gauze window curtains are turquoise blue.

**A** ATTRACTIVE guest bedroom that I saw recently in an English style suburban house has wooden window valances used with a finished effect. They hold a group of two windows on opposite sides of the room in harmony, one valance being used over each group. The shape is a plain rectangle with a raised molding—a triple line of gesso—slightly gilded. The background color is old ivory, on which are painted flat flower designs, one in the center and one toward each end.

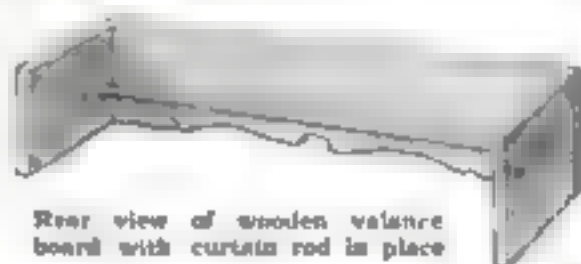
I recently helped a bride who wished to try a window valance made of wood painted to match her breakfast room. She copied an early American valance with a slightly curved lower edge.

After the valance board had gone through the preliminary process of sawing and preparation for painting, she painted the background with peacock blue lacquer. Then, after using two coats of

lacquer and allowing the last to dry overnight, she transferred a floral design by coating the back of her tracing paper with white chalk and tracing over the lines with a medium hard lead pencil. The design formed an oval medallion, 10 in. long.

Another very lovely pair of valances was made by a girl of sixteen for her room. She planned her boards for two single windows on opposite walls, one window being narrower than the other, thus requiring different sized boards. She painted the background tone a light gray-blue enamel to match the background of her draperies. She used three thin coats of enamel, after having first applied a good liquid filler or varnish. As enamels are apt to become marked unless perfectly dry, she waited a day for each coat to dry, and then several days after the last before she transferred her design on the board and painted it in gay colors.

Pictures of distinguished people mentioned in the early history of our country may be cut out, silhouette fashion, and painted black with opaque water color paints, or may be traced from old papers and painted black. These paper designs are glued to the center of the valance boards after a background tone has been



Rear view of wooden valance board with curtain rod in place

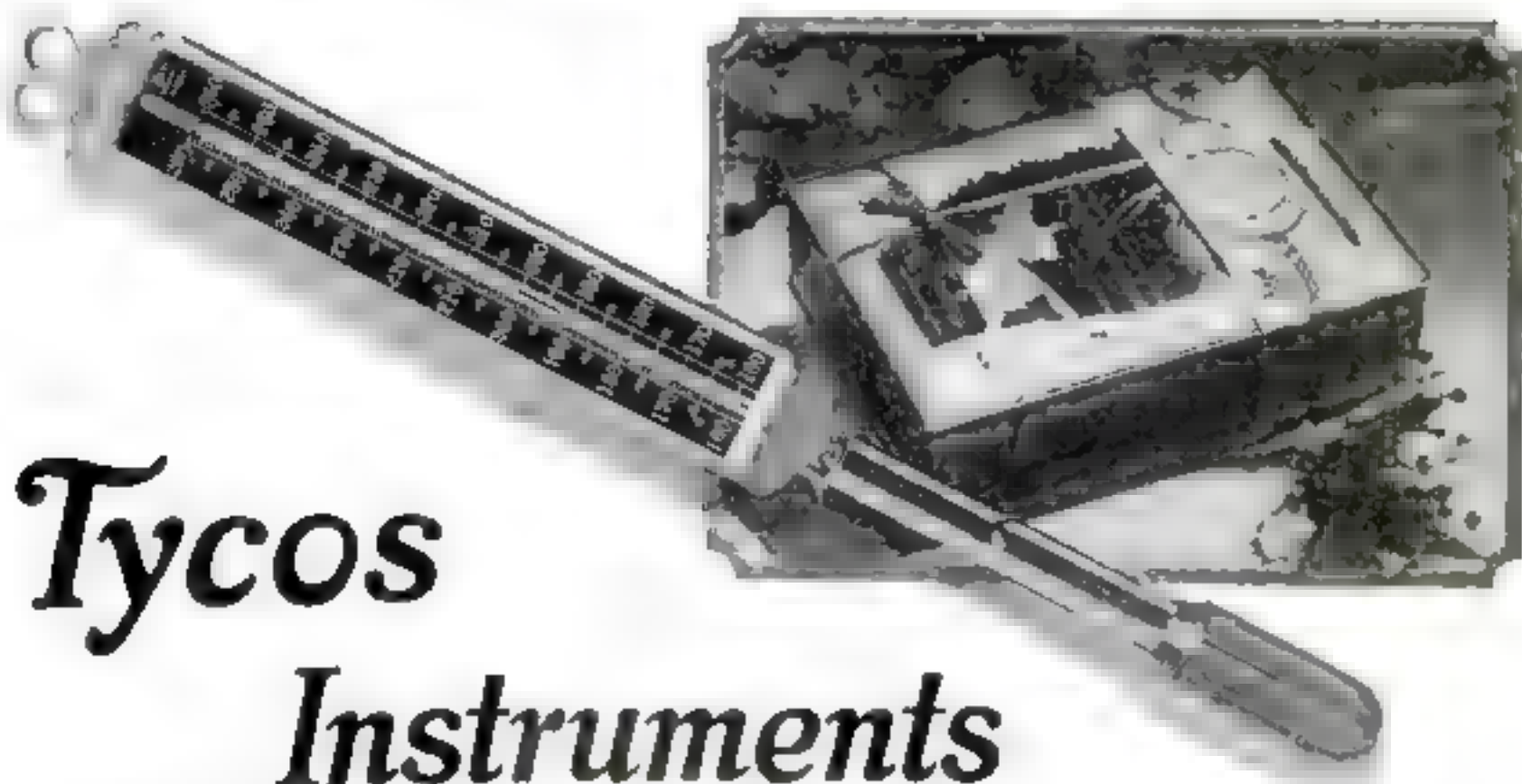
painted. Then a decorative border of black may be painted around them so that the effect is like an old miniature medallion painted on wood. The whole surface of the valance should receive a flat coat of white shellac or of transparent varnish afterward.

Gay colored birds may be cut from wall paper or curtain material and applied as a decoration.

Designs worked out with a keyhole saw are quite effective, as their height above one's eye level in a room makes them resemble open lattice patterns in ornate structural wood carvings. A stock molding may often be used for the upper edge of the valance as a good decorative finish. If one has skill as a craftsman and cares to make his wood valance a more elaborate affair, he may carve and stain it, using gumwood, oak or white pine.

A charming French wood valance in a blue-and-ivory bedroom has rounded corners representing the Greek acanthus leaf; this is carved and gilded in relief. Five-sided oblongs are repeated with a notched effect along the lower edge of the valance. Light blue green silk overdraperies fall in graceful folds to the floor.





# Tycos Instruments

## Tycos - for the Home



**Tycos Office Thermometers**  
An aid in promoting human efficiency

**Tycos Bath Thermometers**  
To enable you to get the most good from your bath.

**Tycos Home Set**  
Bake Oven Thermometer, Candy Thermometer, Sugar Meter. The secret of accurate results in cooking.

**Tycos Wall Thermometers**  
To help you maintain a temperature in your home conducive to good health.

**Tycos Quality Compares**  
To show you the right way in unfamiliar country.

**Tycos Fever Thermometers**  
A necessity in every home.

**Tycos Stormguide**  
Forecasts the weather twenty-four hours ahead with dependable accuracy.

**Tycos Hygrometer**  
To enable you to keep the humidity of the atmosphere in your home correct at all times.

Your dealer will show them to you. Ask us, on a postal, for booklets on any of the above.

## Tycos - for the Medical Profession



**Tycos Sphygmomanometer**, Pocket and Office types

**Tycos Urinalysis Glassware**

**Tycos Fever Thermometers**

By letters on request.

## Help to Maintain the Quality of *Huyler's* Candies

*Says Their Manager of Production*

**T**HE NAME HUYLER'S has always stood for quality and purity in our chocolates, ice cream and other confections. This is what the public expects from us and it is what the public always gets.

To help us maintain the quality and purity of our products we started using Tycos Instruments some four years ago.

The materials contained at one time in one of our holding tanks are worth \$300 or more. Spoilage was always a possibility before Tycos equipment was used but none has occurred since installing their splendid heat indicating and recording devices. This represents a definite money saving—but what is even more important our stores and customers are never disappointed by delays due to spoilage.

Tycos Instruments are important factors in maintaining the high standards for which Huyler's has been famous for 51 years.

### TO MANUFACTURERS

If your manufacturing processes require the indicating, recording or controlling of Temperature there is a type and size of instruments in the Tycos Line of 8,000 varieties that will help you. Informative literature on any type of instrument will be sent you promptly on request, or our engineer will consult with you on the application of Tycos to your particular manufacturing process.

## Taylor Instrument Companies

Main Office and Factory

ROCHESTER, N. Y. U. S. A.

Canadian Plant: 4th BUILDING, TORONTO

SHORT & MASON, Ltd., Manufacturing Distributors in Great Britain

THE SIXTH SENSE OF INDUSTRY

# Tycos Temperature Instruments

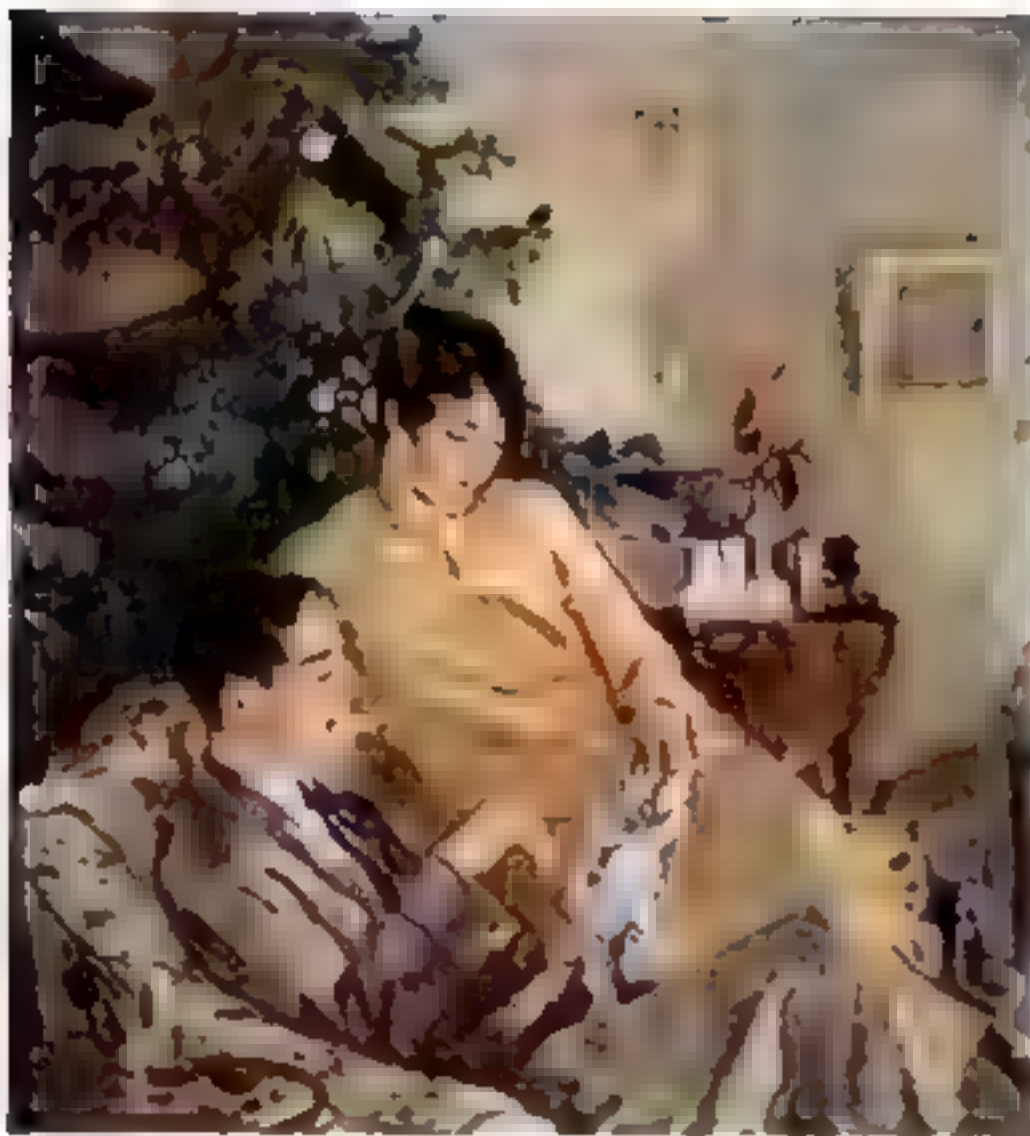
INDICATING • RECORDING • CONTROLLING







**When** the tree is  
trimmed for the great day—when the  
peace and good cheer of  
Christmas are almost here  
—have a Camel!



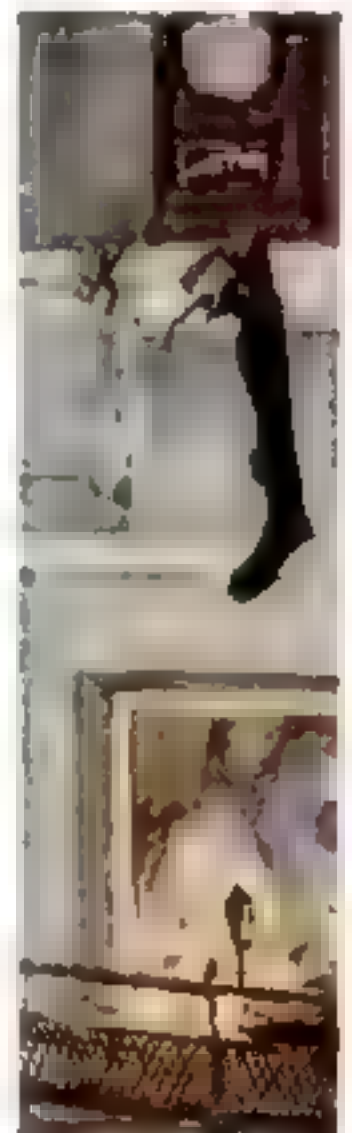
Camels represent the utmost in cigarette quality. The choicest of Turkish and Domestic tobaccos are blended into Camels by master blenders and the finest of French cigarette paper is made especially for them. No other cigarette is like Camels. They are the overwhelming choice of experienced smokers.

WHEN the stockings are hung by the mantel. And the children's tree is ablaze with the gifts and toys for tomorrow's glad awakening. When joyously tired at midnight you settle down by the languishing fire — have a Camel!

For to those who think of others, there is no other gift like Camels. Camel enjoyment enriches every busy day, increases the gladness in giving, makes life's anticipations brighter. Before Camel, no cigarette ever was so good. Camels are made of such choice tobaccos that they never tire the taste or leave a cigarettey after-taste.

So on this Christmas Eve, when your work for others is done — when you're too glad for sleep with thoughts of tomorrow's happiness — have then the mellowest —

*Have a Camel!*



Remember your few closest friends with a supply of Camels for Christmas Day and the days to come. Mail or send your Camel cartons early, so that they will be delivered in ample time.

R. J. Reynolds Tobacco Company  
Winston-Salem, N. C.

Contrast the clumsy dials of only two years back... with the handsome illuminated controls MAR-CO makes today. Here is another good reason for building your set yourself!



## Now dials give place~ to glowing spots of light

**P**ICTURE a soft, subdued light in the room...

- ... your set in the corner with glowing spots of light illuminating its swiftly readable back panel scales.
- ... this is radio at its handsomest...
- ... this is the panel arrangement, the type of skillful tuning, that distinguishes the 1927 trend in set construction.

Already, these new MAR-CO controls are specified or optional equipment in a score of this season's most advanced circuits. At once, they have become the standard in tuning control design. Use them, in whatever set you build, to give the final touch of style, and the utmost in precision control.

MAR-CO controls are easy to install. The steel template pro-

vided reduces panel-drilling to the simple, fool-proof operation illustrated below. The original MAR-CO "friction-drive"—the action that makes backlash impossible—has been strengthened, to accommodate gang condensers. The MAZDA lamp supplied runs on your "A" battery, using only .1 ampere. The switch that controls this lamp may also be used as your filament switch, the lighted scales then serve as pilots. Scales read 0 to 100, or 100 to 0, as preferred. Price, including template, bulb, and bezel, \$3.50. Replacement bulbs, \$2.00. Write today for the booklet that illustrates 15 standard makes of condensers mounted on MAR-CO back-panel controls. Martin-Copeland Company, Providence, R. I. Branch offices and representatives in principal cities.

The VARION,  
The L. C. 27,  
The INFRA-DYNE,  
The R. B. LAB,  
The MADISON-MOORE,  
and over a dozen more of the season's most advanced circuits, specifically call for MAR-CO Controls.

## MAR-CO *Illuminated* Controls

Here's how  
you drill  
the panel..



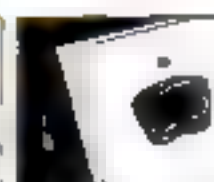
Screw Template  
to panel



Drill holes  
through Template



Remove window  
opening



Bezel covers  
rough edge

that's ALL—  
you CAN'T  
go wrong!



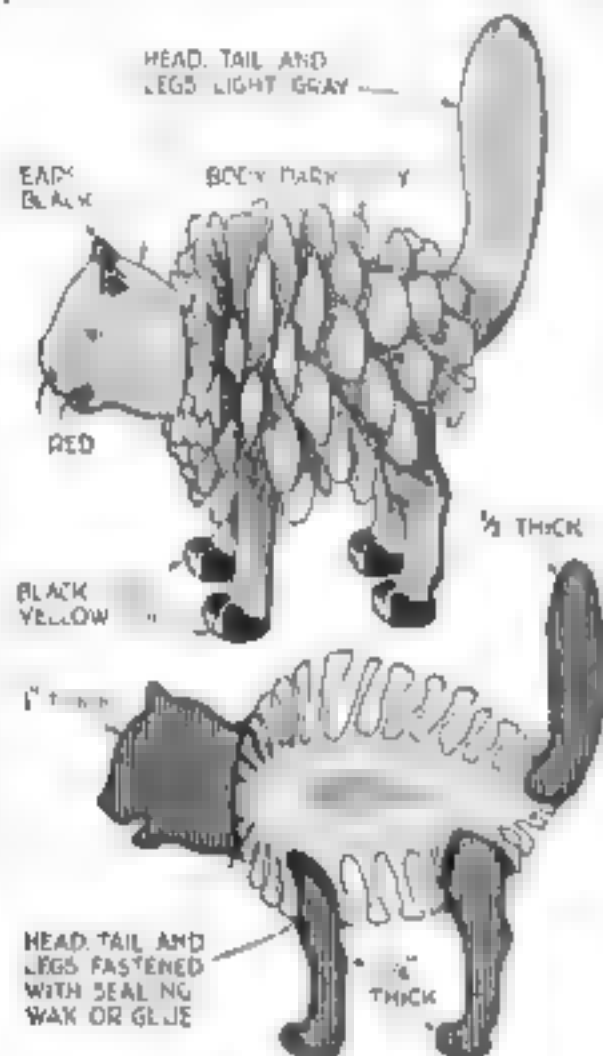
# Pine-Cone Cat "Comicull"

By F. CLARKE HUGHES

**M**ANY interesting toys, like the cat illustrated, may be made from pine cones and a few bits of wood.

To make a cat, select a cone that is as nearly as possible the shape indicated in the accompanying drawing. The size of the head, legs and tail will be regulated by the shape and size of the cone.

The parts should be sawed from soft pine and the corners rounded and



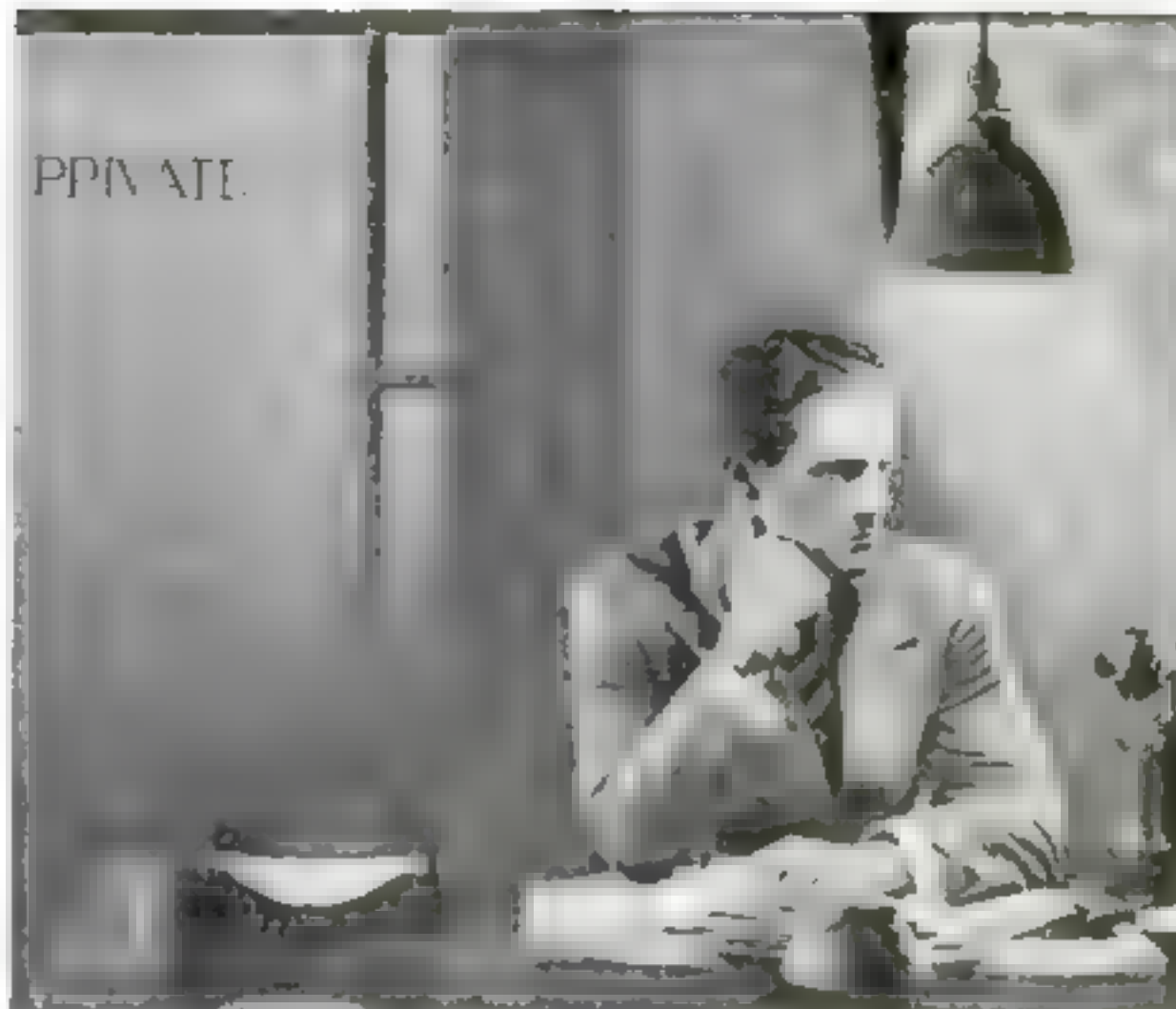
The head, legs and tail are cut from soft wood and fitted carefully to the pine cone

smoothed. Each should then be fitted to the cone and fastened with either glue or sealing wax. All the space between the wood and the cone must be filled to insure tight joints.

It is suggested that the body be painted with dark gray enamel having a gloss finish. The head and tail may be a lighter tone of the same color, and the feet of a contrasting enamel, such as black or white. For the nose and mouth, bright red is a good color; the eyes are black, relieved with a touch of white.

## The Prize Winning Name

"COMICULLS" from the words "comic" and "culls" was the best name submitted in the recent contest to designate the little novelties that Mr. Hughes is describing from month to month. It was suggested by John H. Wack, of Pittsburgh, Pa.



## Held back by—what? —perhaps it's comedones\*

**F**OR five years he had watched men come and go—up to better jobs. He knew he was not stupid. Something kept him back. Something made them promote other men— younger men. What could it be?

It is unfortunate that many men suffer from comedones—the scientific name for blackheads. These disfiguring blemishes keep you from being clean-cut and attractive. They are often responsible for lack of business success. For while you yourself may not be conscious of them, others notice them. You may have wondered why success never comes. Perhaps it's comedones.

Pompeian Massage Cream helps you overcome comedones. It gets in where comedones form, rolls out all dirt and oily secretions. It stimulates a healthy circulation, keeps the pores

open, and gives you a clean, ruddy complexion.

### Try this treatment

After you shave, spread Pompeian Massage Cream generously over your face—and rub. Continue to rub until the cream rolls out. Note how dark the cream looks. That's the dirt that was in your pores.

Don't let comedones form. Use Pompeian Massage Cream every day—especially when social or business engagements demand that you look your best. It means a healthy, wholesome skin. It means more joy in living.



### \*WHAT ARE COMEDONES?

(pronounced jim'-e-dones)

Dictionary definition: A small plug or mass including the excretory duct of a sebaceous gland, occurring frequently upon the face, especially the nose. It is often called black-head.

### Use at Home after Shaving

To get full pleasure and benefit, use Pompeian Massage Cream regularly at home after shaving. Your face will feel and look like a million dollars. See how at all drug stores.

## SEND FOR 10-DAY TRIAL TUBE



For 10c we will send a special trial tube containing sufficient cream for many delightful massages. Positively only one trial tube to a family on this exceptional offer. Use this coupon now.

### TEAR OFF NOW! YOU MAY FORGET

The Pompeian Laboratories,  
Dept. 30, Cleveland, Ohio

Gentlemen: I enclose 10c (a dime, coin preferred) for a special trial tube of Pompeian Massage Cream.

Name: .....

Street Address: .....

City: ..... State: .....





# Better Reception



## Majestic "B" Current Supply

delivers pure direct current from your light socket

### Majestic Standard-B

Capacity seven tubes or six plus 1 power tube. 45 milliamperes at 155 volts

**\$32.50**

West of Rocky Mts., \$35.00

### Majestic Super-B

Capacity one to twelve tubes, including the use of power tubes. 45 mils **\$35.00** at 150 volts.

West of Rocky Mts. \$37.50 (As Illustrated)

### Majestic Master-B

For Radios 25, 28, 30 and Super heterodynes. Operates power tubes. 60 mils at 150 volts.

**\$42.50**

West of Rocky Mts., \$45.00

### No Hum—A Superior Source of Power

The voltage can always be accurately adjusted to meet the varying conditions of every city and on any set.

Economical—cost a fraction of a cent per hour. No acid or liquids; Uses Raytheon Tube; No filament to burn out.

See your dealer today. Insist on a demonstration on YOUR set immediately

(Can be purchased on deferred payments)

**GRIGSBY - GRUNOW - HINDS - CO. 4578 ARMITAGE AVE. CHICAGO-ILL.**



## "D. Maydole"

If you know and appreciate fine tools, you don't have to be told what "D. Maydole" means on a hammer head.

Three generations of hammer users know that Maydole Hammers are as fine as eighty-three years of experience, press-forged tool steel and clear, second-growth, air-dried hickory can make them.

The minute you take a Maydole Hammer in your hand, you'll know by the "hang" that it's your hammer.

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The David Maydole Hammer Co., Norwich, N.Y.

## Decorating with Plastic Paint

(Continued from page 68)



Semicircular sweeps of a 4-in. wall brush produced the so-called monastic texture.

covered with brush marks. A ceiling is not so easy as a wall to do, but we had finished with ours under three hours. In order to get the best effect, however, we went over walls and ceilings after they were thoroughly dried, and with a piece of sandpaper "softened" the "wells" that seemed too sharp. Then because Eleanor—rightfully enough—wanted them washable, we gave the walls and ceilings a coat of size.

The finished job exceeded our anticipations. We had walls and ceiling of different but harmonious tints. We had rough textures that broke up light waves and that diffused a soft glow through the room. And our furniture had an interesting and effective background. In short, we had got out of the commonplace and into the unusual. And of course Eleanor said: "There didn't I tell you! I feared then that I was in for the job of redecorating the whole house."

The dining room was the next point of attack. There the problem was complicated by the fact that the walls had been papered. I have heard of plastic paint jobs over wall paper. Some were satisfactory, but not all. In our case we had determined to do a thorough job. So we removed all the wall paper. Then the entire surface was washed down with a solution of salt soda and hot water. Cracks in the wall were filled with the joint finisher (or patching plaster) used with mineral wallboard, and then sandpapered. It was not necessary to apply a coat of size.

**WE HAD** decided on an Italian texture for the walls of the dining room, because of the certainty of its harmonizing with the Spanish texture of the living room. The color chosen was turquoise blue, with the ceiling lighter than the walls and finished in the monastic texture used in the living room. The pigment and paint were mixed just as before and the Italian texture was developed by leaving large brush marks showing as the plastic paint was applied. As I went ahead with the brush, Eleanor followed behind and smoothed down the brush marks with sweeping strokes of the palm and heel of her hand.

We had improved our technique considerably as a result of our experience in decorating the living room and were able, as a consequence, to finish the dining room walls in the short time of five and a half hours. For some reason—perhaps because we dawdled to admire our handiwork—the dining room ceiling took a half hour longer than that in the living room.

The kitchen was next. There the calcimine was in truly bad condition and we began by washing all the color off, being particular to leave no color in the corners or around the trim. Finding the cleaned surface glossy, we washed it down with steel wool and a strong solution of hot salt soda water. Another washing—with clear water—was necessary to remove all traces of alkali and steel wool. We then let the surface dry before scratching it thoroughly in every direction. We now were ready for the application of the plastic paint.

We had decided on pure white walls and ceiling for the kitchen and a stipple finish, such as is found in many old Colonial homes. Therefore, it was not necessary to color the plastic paint. We merely mixed it to a thick consistency and brushed it on, letting it "set" slightly before we produced our stipple by dabbing the wall all over with a painter's ordinary stippling brush.

**THE** ceiling was treated in the same manner. Our actual working time with the plastic paint, for walls and ceilings, was just over five hours, although we spent an equal time getting the walls and ceilings ready, an hour in light-

The Italian texture, which is copied after a finish found in many fine old Roman villas.

sanding our stipple to remove sharp points, and two hours in "sizing" the finished wall.

For the hallway and the three other rooms in the house we used texture and color-tone effects that were different from one another and from the ones already described. How these were produced, and a description of some small art objects made with plastic paint, will be the subject of a following article.



## Home Workshop

### Full Size Drawings for Constitution Model

**THREE** blueprints giving full size details for building a decorative model of the U. S. frigate *Constitution* are added to our list this month. For a description of this model see page 67. Plans for three other ship models are available, a pirate galleon (Nos. 44 and 45), a gorgeous Spanish galleon (46 and 47), and a clipper ship (51, 52 and 53).

### Complete List of Blueprints

**ANY ONE** of the blueprints listed below can be obtained from **POPULAR SCIENCE MONTHLY** for 25 cents. The corresponding back issue of the magazine, in which the project was described in detail, can be had for 25 cents additional so long as copies are available. The Editor will be glad to answer any specific questions relative to tools, material, or equipment.

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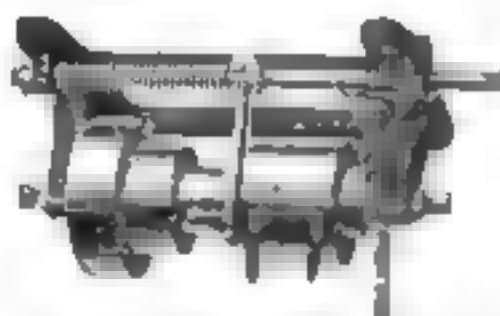
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This lathe has a milled bed and a tail stock with milled base. Live spindle has a cone bearing to take up wear. The tail stock has both screw and lever feed. Cone pulley has 3 steps—1½, 2½, 3½ inches in diameter. The lathe is finished with black and red enamel. All working parts are beautifully polished.

A complete line of attachments is available to fit this lathe. Among them are a slide rest, lathe tools, compression chuck and collets, milling attachments, turret attachments.

### Bench Lathe No. 494

This lathe has the same construction as No. 125 above, but is slightly larger. Length over all, 31 inches; height, 11½ inches; swing, 7 inches; extreme distance between centers, 18 inches. Net weight, 36 pounds. Price \$44.

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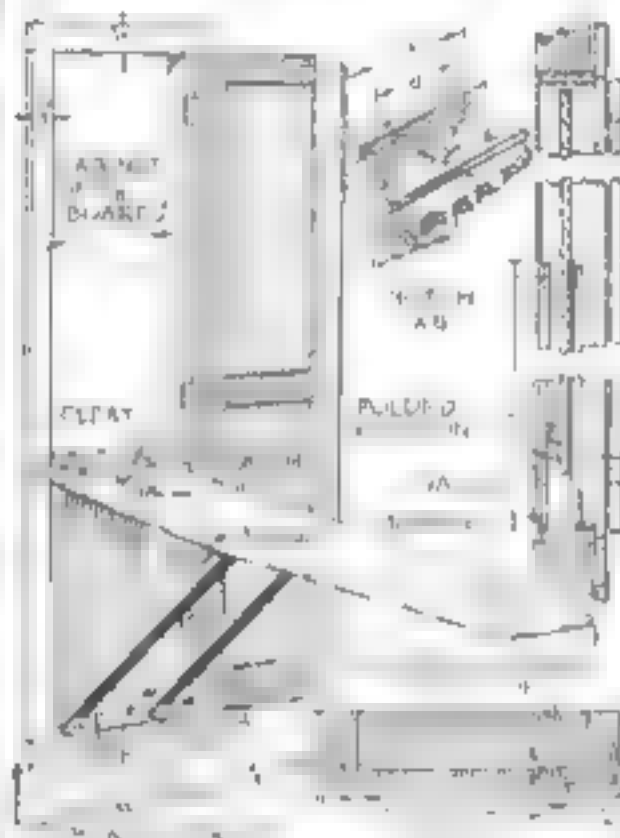
## Foolproof Built-In Ironing Board

By T. M. ANDERSON

**T**O DRAW out the ironing board illustrated, it is necessary only to pull it down from the top. It automatically raises at the base and slides into position, where it remains firmly fixed. There are no loose props or legs to give trouble.

The board is built in a cabinet between two wall studs, which are commonly about 16 in. apart. The cabinet has ¾-in. pine sides and a wallboard back. A 2-in. flange is used to raise the cabinet, thus leaving an opening for the iron of about 14 in., which admits an ironing board 12 in. wide. It should be noted that the casing is not set flush with the cabinet sides, it extends over them at least 1½ in.

In the base of the ironing board, which should be 5 ft. 4 in. long and a notch 1 in. deep and 8 in. wide, as shown in the de-



The ironing board open for use, details of the strong and simple folding mechanism.

tail at the top of the accompanying illustration. Place a board 8 by about 31 in. in the back of the cabinet at the bottom, nailing it from the bottom. Then nail a 1 in. square strip across the top and through the sides of the cabinet. This determines the height of the ironing board when open and should be arranged to suit the stature and preferences of whoever is to do the ironing. A favorite height is 31 in. from the floor. After these parts are in place, set the cabinet bodily between the studs and nail it firmly to the studding.

The notch in the ironing board should fit the board in the back of the cabinet so that the ironing board can slide up and down freely. Cut a 2 in. wide strip as long as the inside width of the cabinet and fasten it to the ironing board from the top side as shown. Round this on one edge and sandpaper it well. It should be placed so that it (Continued on page 87)



## The Home Workshop

### How to Glue Wide Boards Together without Clamps

ANY home worker who wishes to join two wide boards for making a table top or something of that sort and does not have the clamps necessary for doing the job with glue in the ordinary way, may find helpful a method that I have practiced at times with excellent results.

Plane the edges of the boards straight and square, apply liquid glue to both edges to be joined, and place the boards together face down on a bench or level floor. Raise the outer edges on thin pieces of wood so that the face side of the joint will be slightly open and the back edges closed. Then drive corrugated fasteners across the joint at intervals of from 8 to 12 in.

Turn the boards over and place strips under the outer edges so as to raise the whole slightly and leave the joint clear of the bench. Lay sufficient weights on the face of the boards to draw the joint tight and let them stand as if it were in clamps.

The corrugated fasteners hold the joint tight from the back and the weights insure a perfect fit on the face.

Hot glue, of course, cannot be used in this process as it hardens too quickly. The glue I have used exclusively for years in conducting a picture framing and general furniture repair shop is made by pouring enough apple vinegar over the best obtainable grade of brown flake glue to cover it. The container is placed in the sunshine or a warm room and stirred occasionally.

After twelve hours the glue is ready to use. If it becomes too stiff at any time, the receptacle is either placed in the sun or in a basin of hot water for a few minutes. It is used at the same consistency and in the same way as ordinary hot glue but it does not dry so quickly and does not decompose.

If the glue is not to be used for several days, I make it a practice to pour a little vinegar over it and put the container in a cool place.—R. C. STANLEY.

### Foolproof Ironing Board

(Continued from page 86)

will slide up and down against the inside of the facing which was allowed to extend over the cabinet sides  $\frac{1}{2}$  in. for this purpose. The board should now move up and down, but not backward or to either side.

For the braces use two strips 3 in. wide and about 32 in. long. Fasten with two pair of 2 in. square, loose-pin hinges. One pair of hinges is fastened to the inside base of the cabinet, as near the outside edge as will allow the door to close. The other hinges are so placed on the board that it will be held level when fully extended.

On the under side of the board at the back is placed a spring catch such as is used on the cabinet door. This catches in a slot when the board is pulled down to position and is released by hand when the board is to be pushed back into place.

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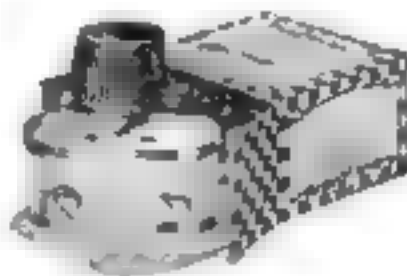


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## "OLD IRONSIDES"

(Continued from page 87)



After the hull has been carried this far, it is ready to be painted and the deck varnished.

1882 she was made a receiving ship at Portsmouth, N. H. She was towed to Boston in 1897; in 1908-7 she received her third reconditioning.

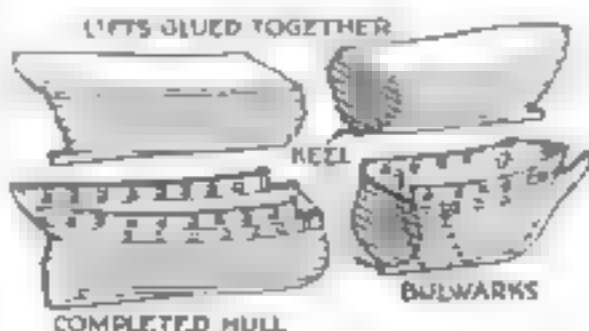
Her principal dimensions are: Length over all 204 ft., beam 43.5 ft., depth of hold 11 ft., displacement, 2200 tons. Her speed was up to about 12½ knots, and her crew up to 500 men.

If the model here represented is carefully made, it will be, in its way, as beautiful as the original ship, presenting in its sturdy lines and heavy armament a sense of invincibility, and in the slender tracery of its lofty spars and ropes, the perfection of rigging that gave her speed.

In the fashioning of the model there are no insuperable difficulties, provided the instructions are followed part by part. Careful, nimble-fingered work will be needed, but that is always a joy to those so inclined. Though she may take a long time to make, she is worth it and will be ornamental in all stages of the construction.

The *Constitution* has been altered in minor details several times, which makes it difficult to state that she was thus-and-thus at such-and-such a time. It would not be fair to make her just as she is now, in her non-seagoing trim. Therefore, some of the early decorative features, as at the head, have been embodied.

On the whole, the model represents her, I believe, about as she was in the War of 1812. There is no certainty, however, that the deck plan given was adopted



After the lifts are glued together, the deck sheet is cut. The hull then is carved to its finished shape and the keel, stern, sternpost, rudder, catheads and bulwarks are added.

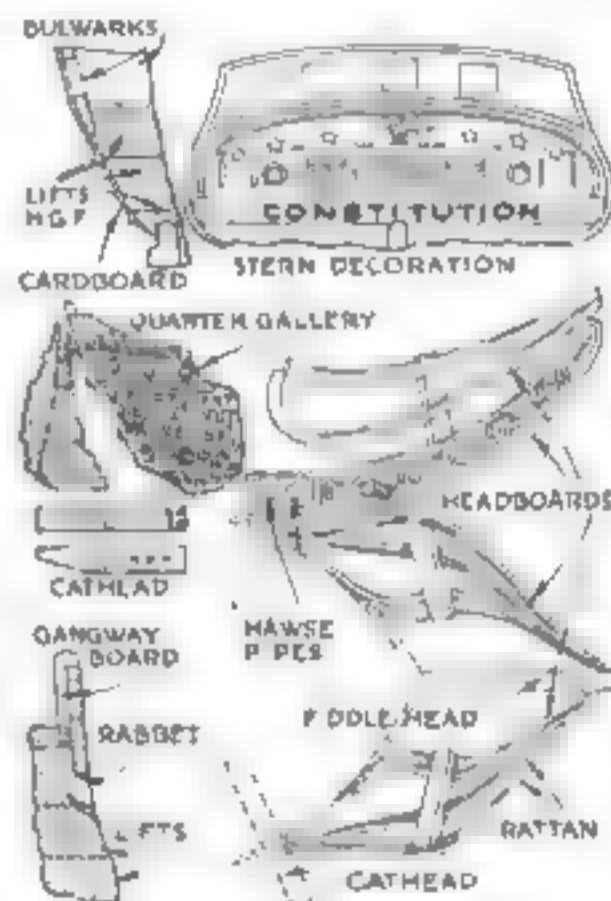
before 1807, and even in that there is no place indicated for the boats.

The plans given here for the model have been adapted and simplified directly from Government blueprints. The scale used is that of 1/16 in. on the model to 1 ft. on the real ship. This gives us a model of 18 in. on the load water line, and 31 in. long from the end of the flying jib boom to the

end of the spanker boom and 24 in. high from keel to main trunk (the over-all dimensions). This is a sizable model for the average room. A larger model may be made, however, by enlarging all the plans given to the desired scale. A smaller model is not advised, if it is wished to keep to scale and embody all the details given.

The rigging has been slightly simplified and not all the details have been used, but the essential and characteristic features are all given.

As with all models, the first things necessary are full sized drawings of every part to be made. It is no easy task, however, even for skilled draftsmen, to lay out



Details of the stern and quarter gallery, the bent headboards, and method of setting the bulwark strips into a rabbit in the hull.

the curves accurately, and you can save yourself all the work of preparing full size drawings by sending 75 cents for Blueprints Nos. 37, 38 and 39 to the Blueprint Service Department, Popular Science Monthly, 40 Fourth Avenue, New York (see page 81). These sheets contain all the full size drawings you will need—hull, rigging and details. They will save you many hours of tedious work.

To make the hull, eight pieces of white pine will be needed. These will be from 10 to 12 in. long by 2 1/4 to 4 1/4 in. wide by 1/2 in. thick (3/4-in. stock, dressed). Draw a line right round the center of each lengthwise. Transfer from Blueprint No. 37, or from your own full size drawing, one of the lift plan lines A to H on each piece of wood, and also mark the constructional lines H to XI. Be careful that the center line of the plan corresponds in each instance with the line on the wood. This is best done by cutting the plan at the line or by first taking the lines off on tracing paper and scribing through carbon paper on to the wood.

These pieces must now be cut out with a coping, fret. (Continued on page 89)



## "OLD IRONSIDES"

(Continued from page 88)



The decorated hull board and the head rails, which curve upward to meet the stern.

or jig saw. Keep well outside the pencil lines so that the wood may be dressed up with sandpaper before joining. Continue the construction lines II to XI and the fore-and-aft lines around the edges and be careful to indicate on the edge of each lift which is the bow end.

It should be noted that with this ship the upper lifts are wider, because of the "tumble-home," on the lower edge than the upper, and ships, but like the lower ones are wider above than below at the ends. Therefore, the greatest width at any position has been given in the half breadth plan. The idea of this may be seen in the body plan, but it will explain itself as you proceed: the main point is to leave sufficient stock everywhere for the subsequent shaping operations.

Parts B to G may have their centers cut out, to lighten the model, if you wish.

**N**OW glue all these lifts together. See that the construction lines at the sides and ends form continuous straight lines. Each part may be lightly nailed to the next as you build up, the nails being



Another view of the bow, which shows the graceful way in which the headboards are bent.

on the inside with their heads well sunk, or the whole may be clamped together before gluing, and bored to take two dowels, which are inserted in the bottom piece so that

(Continued on page 90)

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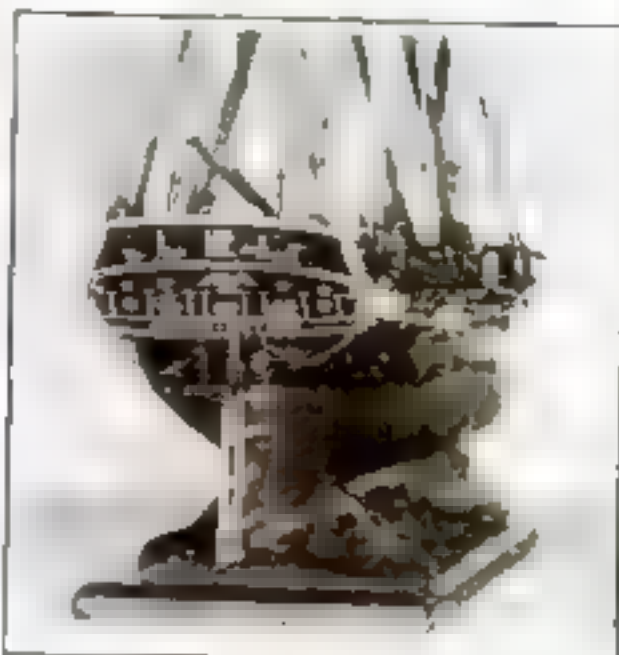
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## "OLD IRONSIDES"

(Continued from page 89)



The hull from stern. The decorations are painted on cardboard and glued in place.

the other lifts may be dropped on, as glued. The ends of the dowels must come under the hatches so that they will not show on the deck. Leave the lifts in clamps or under heavy weights for at least twelve hours to dry.

From the sheer plan transfer to the wood the dotted line that represents the deck; also mark the stem and stern profiles. Cut away the waste wood. Make the deck a smooth curve from stem to stern, slightly higher in the center than at the edges. On the deck mark the deck outline, which is the top edge of piece H.

On to this cardboard mark the body plan lines I to XI and cut them out to form templates to fit on the outside of the hull during the shaping process. Now shave away the projecting corners of the lifts until you have smooth curves, vertically and horizontally, which correspond with the templates when held at their respective positions. A plane, chisel, gouge, spokeshave and half-round cabinet rasp or wood file are all useful for this, especially the latter two.

**BE CAREFUL** in shaping the hull. Work quickly, if you like, but not hastily. All the rest will be waste if your hull is not correct.

The keel is  $\frac{3}{4}$  by  $\frac{1}{4}$  by  $16\frac{1}{4}$  in. and extends under the stem and sternpost. It is glued and nailed on. The stem and sternpost, which are of the same thickness, are cut from the sheer plan to shape and fastened similarly. See that the ends of the hull itself run neatly to them.

Scratch in the water line, which it will be noted, is not parallel with the keel. Mark in also the lower edge of the main deck gun ports and their vertical edges with reference to the ports which are to come above them. In the center of each square thus formed, bore a  $\frac{3}{16}$ -in. hole  $\frac{1}{4}$  in. deep carefully at right angles to the ship's side and slightly down from the horizontal (so that the guns will point very slightly up). The aftermost ports are dummy and have windows painted on instead of guns. (Continued on page 91)

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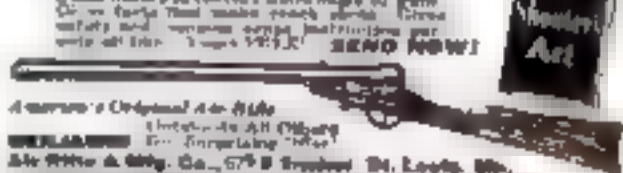
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*Time*

## "OLD IRONSIDES"

(Continued from page 90)

Right around the top edge cut a rabbet (recess)  $\frac{3}{4}$  in. down and  $\frac{1}{2}$  in. deep into the hull. From white pine make two pieces a full  $\frac{1}{2}$  in. thick,  $1\frac{1}{2}$  in. wide and 20 in. long. Shape the lower edge to the deck line and cut out the gun ports after marking them from the sheer plan. The top edges of these pieces should really be  $\frac{1}{2}$  in. thick but it is safer to make them a little thicker.

Now glue and nail these pieces in the rabbet after the bow ends have been strained to make them bend easily. The two edges should be cut to fit together neatly at the bow. They may need strengthening with a small block or elbow, to keep them together; it can be seen in the deck plan.

Cut the stern bulwark and fasten that on similarly with neat joints at the corners. Now shave the top of the bulwarks until you get the lines as shown on the plan, and cut away the gangways, so that



Stern view showing cardboard strips glued on to represent the pistles and gudgeons

the bulwarks there stand up only a bare  $\frac{1}{8}$  in. above the deck.

Make the gangway boards of hard wood. Sink the lower ends into the deck and nail them to the edges of the bulwarks (as shown on page 88).

The rudder may be seen above and in the sheer plan. It extends into the hull under the transom and can be fastened with double-pointed nails. The plates for the pistles and gudgeons (hinges) may be simulated with cardboard strips, glued on.

**T**HE catheads, which come next, are of any reasonably tough wood, about  $\frac{1}{2}$  in. square by  $1\frac{1}{4}$  in. long. Each projects through a hole in the bulwark. The outer end has three holes fore-and-aft for the boom guys and four vertical holes at the end for the cat fall, the inner end is beveled to lie flat on the deck, to which it is glued and nailed. Note in the sheer plan how the cathead slants forward and upward.

Bore a  $\frac{3}{4}$ -in. hole for the bowsprit, a  $\frac{1}{4}$ -in. hole

(Continued on page 94)

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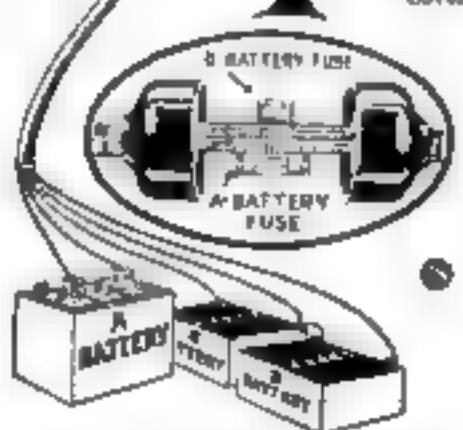
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## The Home Workshop

### "OLD IRONSIDES"

(Continued from page 81.)

through the cutwater for the gunnoring lashing, and two small holes for the bolstays, as in the sheer plan.

The headboards may be made next. The wide lower members, which carry the painted scrollwork and lead up to the fiddle head, are thin pieces of waterproof three-ply wood (or a solid piece of soft wood) 3" in. long; they will require to be steamed until quite soft. The first 1/2 in. is firmly glued and nailed under the gun port streak; the remainder is bent out sharply and the upper ends are glued and nailed through to the stem just under the curl. The narrower members are, for preference, pieces of flat rattan (canoe), glued and nailed under the catheads and to the cutwater.

The headboards are strengthened with a piece of wood placed inside of each half-way along its length, this may be notched to fit over the headboard members so as to form lapped joints. Two shallow 1/2-in. holes are bored through the lower ends of the headboards into the hull for the hawse pipes.

The stern decoration had better be painted on a thin piece of black cardboard and glued on. The eagle is gold, with a red, white and blue shield, the other ornamentation, the name and the moldings are white. Before being painted, the moldings and decorations may be raised with gesso, which is a mixture of glue and whiting with a little varnish and linseed oil. It also can be obtained ready to use.

**T**HE stern windows may be cut out of the cardboard on three sides only and the flaps lifted to form shutters.

The quarter galleries are pieces of soft wood, cut to the shape shown on page 88 and glued on so that their after edges are level with the stern of the hull. They have windows and scrollwork painted on them. The windows may be painted blue and white on tin foil or thin celloid.

That completes the building of the hull. The deck should be given two thin coats of clear spar varnish, and the outside of the hull two coats of flat white paint, each coat rubbed with fine sandpaper. The hull then can be given two coats of copper-bronze paint up to the water line and two coats of black above, except on the gun port line, which is white between the ports and right up to the stem. The inside of the bulwarks and the edges of the upper (rigate) deck gun ports are white.

**A** ROLLER cradle to stand the model in while working on it will be necessary. The uprights, which may be nailed to a board, should fit the sides of the hull loosely and be lined with a piece of felt or cloth. If a hole is bored in the center of the board in which to fit a peg on another board, a turntable may be formed whenever desired to make it easy to work on alternate sides of the model without having to pick it up or walk around it.

This work will keep you busy until next month, when the deck fittings and spars will be described.

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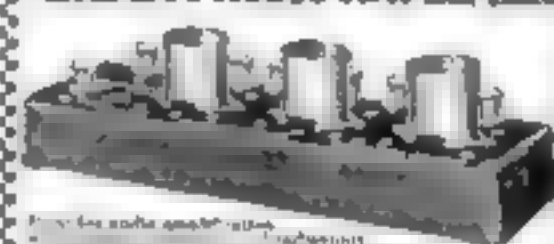
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406, 408, 410, 412, 414, 416, 418, 420, 422, 424, 426, 428, 430, 432, 434, 436, 438, 440, 442, 444, 446, 448, 450, 452, 454, 456, 458, 460, 462, 464, 466, 468, 470, 472, 474, 476, 478, 480, 482, 484, 486, 488, 490, 492, 494, 496, 498, 500, 502, 504, 506, 508, 510, 512, 514, 516, 518, 520, 522, 524, 526, 528, 530, 532, 534, 536, 538, 540, 542, 544, 546, 548, 550, 552, 554, 556, 558, 560, 562, 564, 566, 568, 570, 572, 574, 576, 578, 580, 582, 584, 586, 588, 590, 592, 594, 596, 598, 600, 602, 604, 606, 608, 610, 612, 614, 616, 618, 620, 622, 624, 626, 628, 630, 632, 634, 636, 638, 640, 642, 644, 646, 648, 650, 652, 654, 656, 658, 660, 662, 664, 666, 668, 670, 672, 674, 676, 678, 680, 682, 684, 686, 688, 690, 692, 694, 696, 698, 700, 702, 704, 706, 708, 710, 712, 714, 716, 718, 720, 722, 724, 726, 728, 730, 732, 734, 736, 738, 740, 742, 744, 746, 748, 750, 752, 754, 756, 758, 760, 762, 764, 766, 768, 770, 772, 774, 776, 778, 780, 782, 784, 786, 788, 790, 792, 794, 796, 798, 800, 802, 804, 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1172, 1174, 1176, 1178, 1180, 1182, 1184, 1186, 1188, 1190, 1192, 1194, 1196, 1198, 1200, 1202, 1204, 1206, 1208, 1210, 1212, 1214, 1216, 1218, 1220, 1222, 1224, 1226, 1228, 1230, 1232, 1234, 1236, 1238, 1240, 1242, 1244, 1246, 1248, 1250, 1252, 1254, 1256, 1258, 1260, 1262, 1264, 1266, 1268, 1270, 1272, 1274, 1276, 1278, 1280, 1282, 1284, 1286, 1288, 1290, 1292, 1294, 1296, 1298, 1300, 1302, 1304, 1306, 1308, 1310, 1312, 1314, 1316, 1318, 1320, 1322, 1324, 1326, 1328, 1330, 1332, 1334, 1336, 1338, 1340, 1342, 1344, 1346, 1348, 1350, 1352, 1354, 1356, 1358, 1360, 1362, 1364, 1366, 1368, 1370, 1372, 1374, 1376, 1378, 1380, 1382, 1384, 1386, 1388, 1390, 1392, 1394, 1396, 1398, 1400, 1402, 1404, 1406, 1408, 1410, 1412, 1414, 1416, 1418, 1420, 1422, 1424, 1426, 1428, 1430, 1432, 1434, 1436, 1438, 1440, 1442, 1444, 1446, 1448, 1450, 1452, 1454, 1456, 1458, 1460, 1462, 1464, 1466, 1468, 1470, 1472, 1474, 1476, 1478, 1480, 1482, 1484, 1486, 1488, 1490, 1492, 1494, 1496, 1498, 1500, 1502, 1504, 1506, 1508, 1510, 1512, 1514, 1516, 1518, 1520, 1522, 1524, 1526, 1528, 1530, 1532, 1534, 1536, 1538, 1540, 1542, 1544, 1546, 1548, 1550, 1552, 1554, 1556, 1558, 1560, 1562, 1564, 1566, 1568, 1570, 1572, 1574, 1576, 1578, 1580, 1582, 1584, 1586, 1588, 1590, 1592, 1594, 1596, 1598, 1600, 1602, 1604, 1606, 1608, 1610, 1612, 1614, 1616, 1618, 1620, 1622, 1624, 1626, 1628, 1630, 1632, 1634, 1636, 1638, 1640, 1642, 1644, 1646, 1648, 1650, 1652, 1654, 1656, 1658, 1660, 1662, 1664, 1666, 1668, 1670, 1672, 1674, 1676, 1678, 1680, 1682, 1684, 1686, 1688, 1690, 1692, 1694, 1696, 1698, 1700, 1702, 1704, 1706, 1708, 1710, 1712, 1714, 1716, 1718, 1720, 1722, 1724, 1726, 1728, 1730, 1732, 1734, 1736, 1738, 1740, 1742, 1744, 1746, 1748, 1750, 1752, 1754, 1756, 1758, 1760, 1762, 1764, 1766, 1768, 1770, 1772, 1774, 1776, 1778, 1780, 1782, 1784, 1786, 1788, 1790, 1792, 1794, 1796, 1798, 1800, 1802, 1804, 1806, 1808, 1810, 1812, 1814, 1816, 1818, 1820, 1822, 1824, 1826, 1828, 1830, 1832, 1834, 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2168, 2170, 2172, 2174, 2176, 2178, 2180, 2182, 2184, 2186, 2188, 2190, 2192, 2194, 2196, 2198, 2200, 2202, 2204, 2206, 2208, 2210, 2212, 2214, 2216, 2218, 2220, 2222, 2224, 2226, 2228, 2230, 2232, 2234, 2236, 2238, 2240, 2242, 2244, 2246, 2248, 2250, 2252, 2254, 2256, 2258, 2260, 2262, 2264, 2266, 2268, 2270, 2272, 2274, 2276, 2278, 2280, 2282, 2284, 2286, 2288, 2290, 2292, 2294, 2296, 2298, 2300, 2302, 2304, 2306, 2308, 2310, 2312, 2314, 2316, 2318, 2320, 2322, 2324, 2326, 2328, 2330, 2332, 2334, 2336, 2338, 2340, 2342, 2344, 2346, 2348, 2350, 2352, 2354, 2356, 2358, 2360, 2362, 2364, 2366, 2368, 2370, 2372, 2374, 2376, 2378, 2380, 2382, 2384, 2386, 2388, 2390, 2392, 2394, 2396, 2398, 2400, 2402, 2404, 2406, 2408, 2410, 2412, 2414, 2416, 2418, 2420, 2422, 2424, 2426, 2428, 2430, 2432, 2434, 2436, 2438, 2440, 2442, 2444, 2446, 2448, 2450, 2452, 2454, 2456, 2458, 2460, 2462, 2464, 2466, 2468, 2470, 2472, 2474, 2476, 2478, 2480, 2482, 2484, 2486, 2488, 2490, 2492, 2494, 2496, 2498, 2500, 2502, 2504, 2506, 2508, 2510, 2512, 2514, 2516, 2518, 2520, 2522, 2524, 2526, 2528, 2530, 2532, 2534, 2536, 2538, 2540, 2542, 2544, 2546, 2548, 2550, 2552, 2554, 2556, 2558, 2560, 2562, 2564, 2566, 2568, 2570, 2572, 2574, 2576, 2578, 2580, 2582, 2584, 2586, 2588, 2590, 2592, 2594, 2596, 2598, 2600, 2602, 2604, 2606, 2608, 2610, 2612, 2614, 2616, 2618, 2620, 2622, 2624, 2626, 2628, 2630, 2632, 2634, 2636, 2638, 2640, 2642, 2644, 2646, 2648, 2650, 2652, 2654, 2656, 2658, 2660, 2662, 2664, 2666, 2668, 2670, 2672, 2674, 2676, 2678, 2680, 2682, 2684, 2686, 2688, 2690, 2692, 2694, 2696, 2698, 2700, 2702, 2704, 2706, 2708, 2710, 2712, 2714, 2716, 2718, 2720, 2722, 2724, 2726, 2728, 2730, 2732, 2734, 2736, 2738, 2740, 2742, 2744, 2746, 2748, 2750, 2752, 2754, 2756, 2758, 2760, 2762, 2764, 2766, 2768, 2770, 2772, 2774, 2776, 2778, 2780, 2782, 2784, 2786, 2788, 2790, 2792, 2794, 2796, 2798, 2800, 2802, 2804, 2806, 2808, 2810, 2812, 2814, 2816, 2818, 2820, 2822, 2824, 2826, 2828, 2830, 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3164, 3166, 3168, 3170, 3172, 3174, 3176, 3178, 3180, 3182, 3184, 3186, 3188, 3190, 3192, 3194, 3196, 3198, 3200, 3202, 3204, 3206, 3208, 3210, 3212, 3214, 3216, 3218, 3220, 3222, 3224, 3226, 3228, 3230, 3232, 3234, 3236, 3238, 3240, 3242, 3244, 3246, 3248, 3250, 3252, 3254, 3256, 3258, 3260, 3262, 3264, 3266, 3268, 3270, 3272, 3274, 3276, 3278, 3280, 3282, 3284, 3286, 3288, 3290, 3292, 3294, 3296, 3298, 3300, 3302, 3304, 3306, 3308, 3310, 3312, 3314, 3316, 3318, 3320, 3322, 3324, 3326, 3328, 3330, 3332, 3334, 3336, 3338, 3340, 3342, 3344, 3346, 3348, 3350, 3352, 3354, 3356, 3358, 3360, 3362, 3364, 3366, 3368, 3370, 3372, 3374, 3376, 3378, 3380, 33



## Hanging Bookracks

(Continued from page 78)

shelves should be made  $\frac{5}{8}$  in. wider than indicated.

The bookrack illustrated in Fig. 3 is similar to the one just described, except that it is fitted with drawers between the two lower shelves instead of doors. The construction of the drawers is clearly shown in the detail.

Figure 4 shows a knockdown bookrack. This type is convenient because it can be taken apart and packed so that it takes up very little room. It is made so that it can either hang on a wall or stand on a table.

The sides and shelves are first planed to dimensions, after which the mortises and tenons connecting the upper and lower shelves with the sides are laid out. This must be done very carefully to insure a workmanlike job. It is best to gauge lines with a marking gage from the front edges only of shelves and sides. Set the gage to 1 in. and mark all lines corresponding to that dimension, then set it to  $2\frac{1}{2}$  in. and gauge again from the front edges, then to  $3\frac{1}{2}$  in., and finally to 6 in.

Bore the through mortises with a  $\frac{1}{4}$

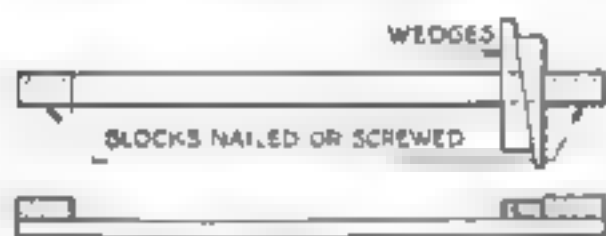


Fig. 5. Homemade gluing clamps for use when large iron clamps are not available.

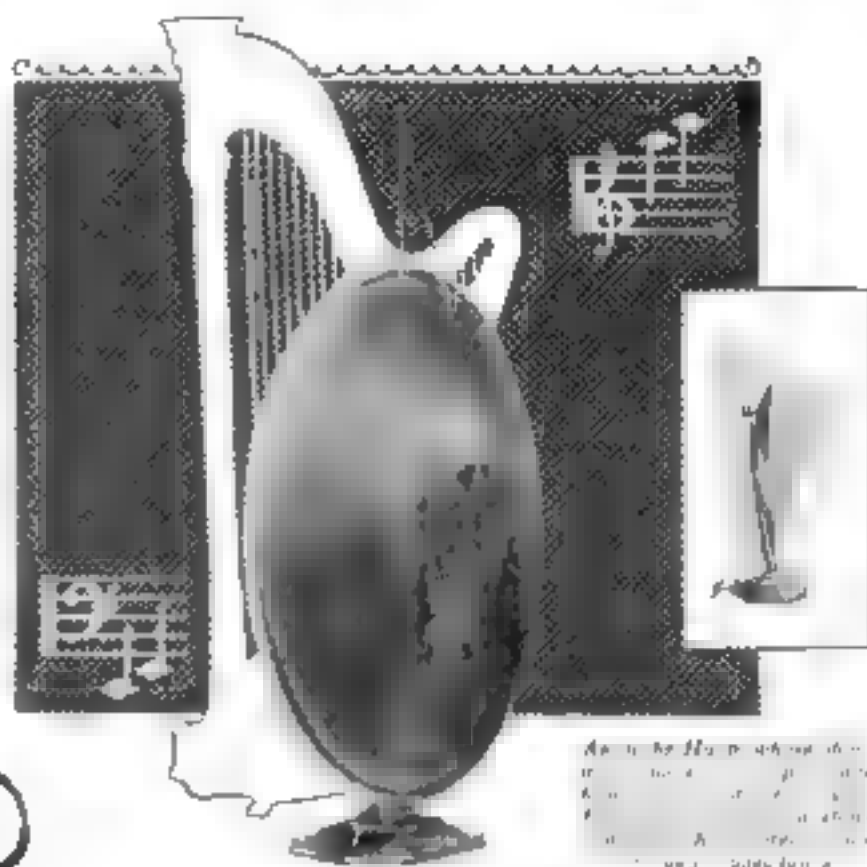
in. auger bit and square and clean the hole with a chisel, using it from both sides so as not to chip the edges. The tenons are sawed with a back saw and the waste pieces between them are chiseled away. After they are fitted the holes are laid out for the keys. Remember that these holes must be chiseled in such a way that the keys will always bear against the sides when driven home, thus forcing the joints together.

A dado is cut for the middle shelf, but it is stopped at both edges, so that the shelf will not be able to slide out. A small strip of wood  $\frac{3}{8}$  by 1 in. is glued to each shelf as a stop for the books, if the rack is to be used standing.

Iron or heavy brass plates of the same width as the thickness of the sides and about 3 in. long are screwed to the back of the sides, and the bookracks are hung from them.

The kind of lumber to be used and how it is to be finished should be dependent on the other furnishings of the room in which the bookrack is to be placed.

This is the first of a series of articles by Mr. Hjorth, who is an authority on furniture construction. He is the author of "Reproduction of Antique Furniture"; he was formerly Director of Technical Work in the Roman Baldorloty de Castro Technical School, San Juan, Porto Rico, and is now in charge of the Architectural Laboratory at Saunders Trade School, Yonkers, N. Y.



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## How I Earned the Cost of a New Water Heater

By THOMAS W. BENSON

IN MANY old houses the coal stove is being removed from the kitchen and a radiator installed to heat the room. The problem of furnishing hot water is then solved by installing a tank and heater in the basement.

Because of this change it often happens that the house owner has on hand a good horizontal water heater from the old range but has to discard it and buy an upright tank. It is not practical to use these tanks in a horizontal position when a gas water heater is employed, because practically the entire tank must be heated before hot water can be drawn from the faucets. Where a masonry stove or a coal in the regular house heater warmed the tank may be mounted horizontally and will work satisfactorily.

The writer, who was confronted with these problems, devised a system of piping the horizontal boiler so it could be used vertically. This makes it possible to use a gas water heater during the months when the furnace is out.

The method of piping the tank is shown in the illustration. The four outlets to the tank are shown in a row merely for the sake of convenience and clearness.

The holes in the tank were already tapped for  $\frac{1}{2}$ -in. pipe. The discharge from the heating coil was continued up to within 6 in. of the top of the tank by a  $\frac{1}{2}$ -in. pipe tapped into the end of a  $\frac{1}{2}$ -in. pipe, which was screwed into the head of the tank. Likewise, the pipe leading to the hot water lines was continued to within 4 in. of the top of the tank. The other outlets were piped as shown.

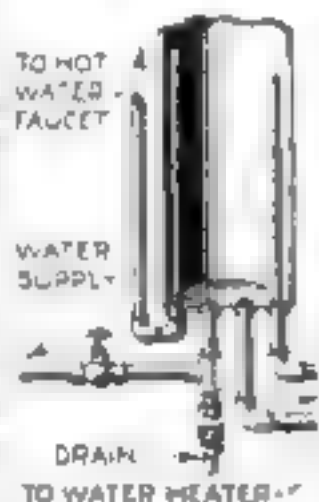
A GAS heater is employed in summer while a sage-stem coal in the house furnace serves the same purpose in winter.

It would appear that the hot water having to flow down through the body of cold water, would be unduly chilled, but the chilling is slight because the water around the outlet pipe warms up and, as it rises, warms the area around the pipe.

Occasionally air collects in the top of the tank and is discharged with a sputter at the faucets when it collects in such amounts as to reach the discharge pipe but otherwise the plan is not objectionable. In fact, the presence of the air acts to absorb partially the water hammer caused when faucets are suddenly closed.

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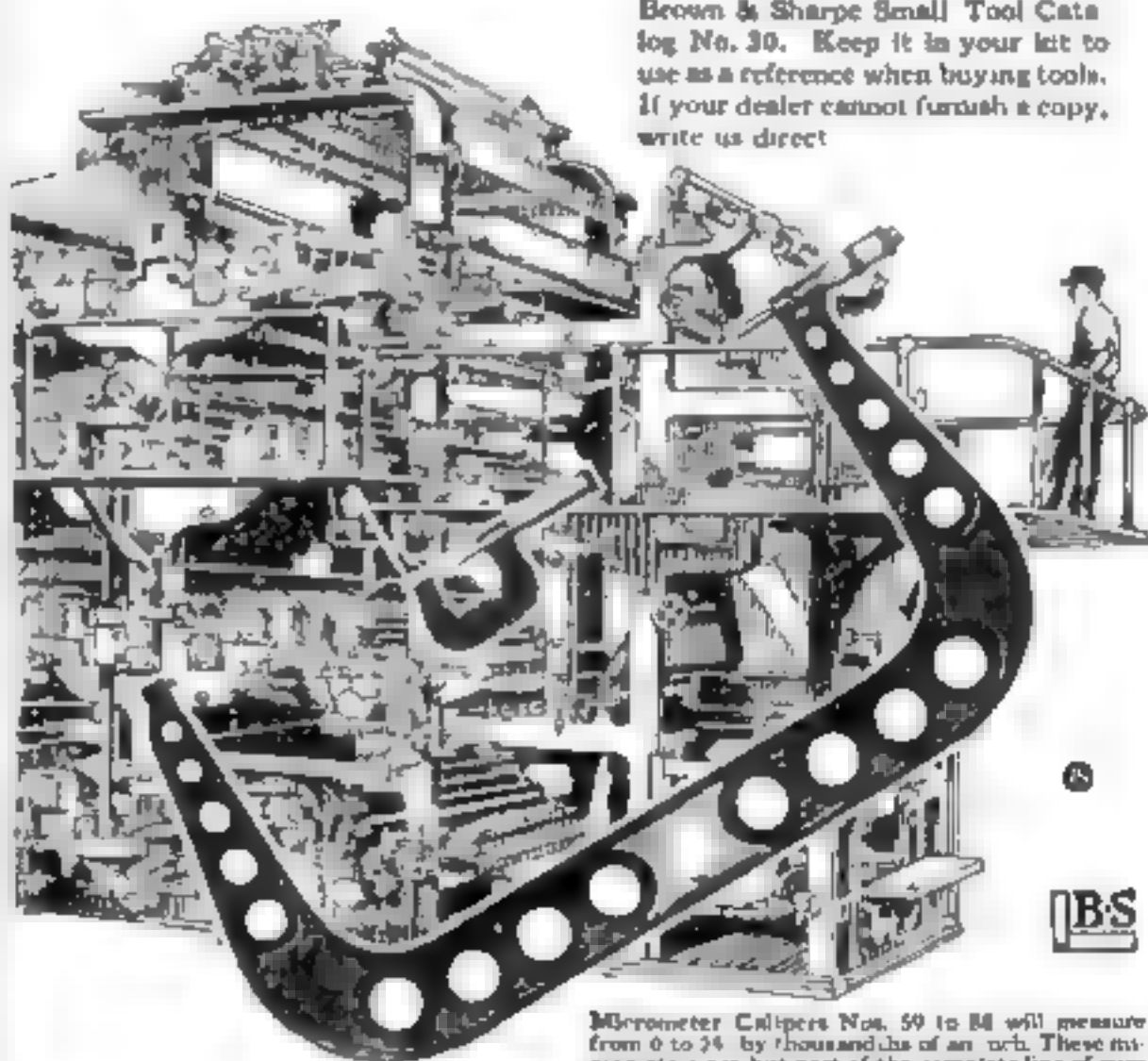


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## Mr. Home Workshop

### Decorative Book Trough with Candlesticks

DECIDEDLY novel and artistic is the book trough illustrated, yet it is of simple construction. A figured hardwood may be used if the piece is to be varnished, or a plainer wood if polychromed.

The trough itself is made of two pieces  $2\frac{1}{2}$  by  $5\frac{1}{2}$  by  $12\frac{1}{2}$  in. Make notches in the upper corners  $\frac{1}{2}$  by 1 in. and round off the shoulders to a radius of  $\frac{1}{4}$  in. Then miter the lower edges, as shown in the detail.

Before marking the end pieces, rule a 6 by 8 in. piece of cardboard into  $\frac{1}{2}$ -in. squares and copy the outline for half the design. Cut this out and trace it on 1-in. stock, reversing the pattern to mark the other half. Shape the piece with compass and coping saws and smooth the edges carefully with a wood rasp and sandpaper.

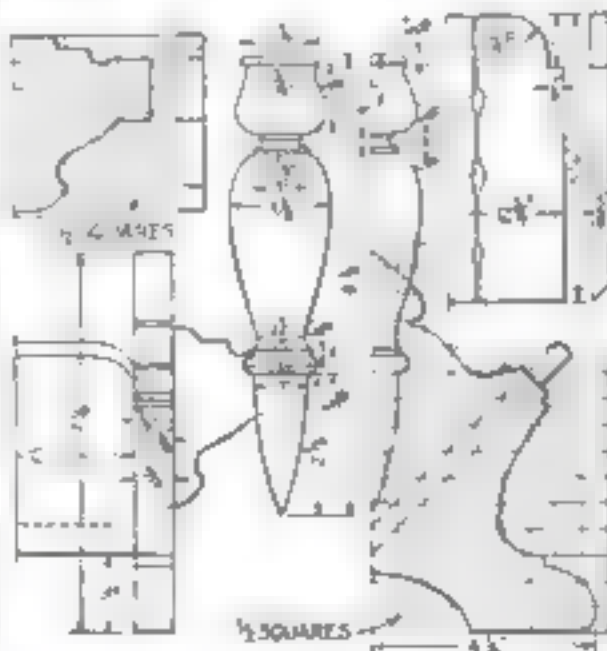
Notice that the ends of the trough are housed into the end pieces  $\frac{1}{4}$  in. deep. The mortises can be laid out from the pattern. Hollow them by cutting across the grain with a narrow chisel and work carefully to avoid braining the corners. Also cut mortises centering on the outside  $\frac{1}{2}$  in. by  $3\frac{1}{4}$  in. and  $\frac{1}{2}$  in. deep to receive the brackets.

The pattern for the brackets is made in the same manner as for the ends, on cardboard 3 by  $3\frac{1}{2}$  in. When shaped, glue the brackets into the ends and assemble the ends and the trough.

The candlesticks are  $8\frac{1}{2}$  in. long and  $1\frac{1}{2}$  in. in diameter at the thickest



A very attractive piece for the reading table



Working drawings of book trough and details of the trough ends and candlestick brackets

point. Bore the sockets 1 in. deep with a  $\frac{1}{4}$ -in. bit. Mortise each stick  $\frac{1}{2}$  in. deep to receive the bracket ends.

If no lathe is available, the candlesticks can be sawed out four-sided, following the same profile. Finish with stain, filler and varnish or with opaque colors. —EDWIN M. LOVE.



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## Metal Magic

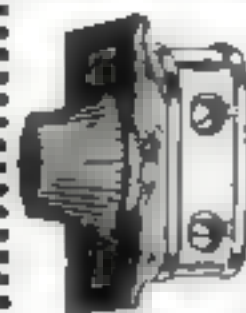
If you've never used Kester Metal Mender before, you'll think it's magic—it's easy to use. Think of soldering as well as an expert, right in your home. You can—just ask your dealer for Kester, the solder anyone can use.



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## Home Workshop Chemistry

Simple Formulas that Will Save Time and Money

**PRECIPITATED** chalk is a white and very light powder, which can be obtained at any drug store. It is one of the preparations of chalk, the commonest and most familiar of which is sold under the name of whiting at all paint stores.

Whiting is very cheap and its most common use is in putty used for glazing and filling nail holes and cracks.

In the home workshop the main value of precipitated chalk (or whiting) lies in the ability it has to unite with other substances to form putty and cement. It is less frequently used for preparing cleaning powders.

As a putty it is used for fastening window panes, assembling aquariums, and cementing joints in gas and water pipes. A putty for this purpose must never dry to such an extent that it will be shattered easily by vibration. The chalk, therefore, should be mixed to a soft paste with raw linseed oil, which dries much more slowly than the boiled variety.

The tendency is to mix the putty too stiff. Indeed, it often pays to add raw linseed oil to prepared commercial putty. When putty is to be used for an aquarium or for the tightening of piping, at least fifty percent of red lead is added to the whiting. Enough raw linseed oil should be added to make a soft paste. Place plenty of this putty around the edges of the glass and force it firmly into the frame. Remove the surplus with a knife. Next cover the inside edges thickly with putty and protect these edges later with narrow strips of glass, as shown, so that almost no surface is exposed to the water. This tends to seal the putty from the air and water and helps to keep it soft. Incidentally, keep water in any aquarium for at least one week before stocking it with fish.

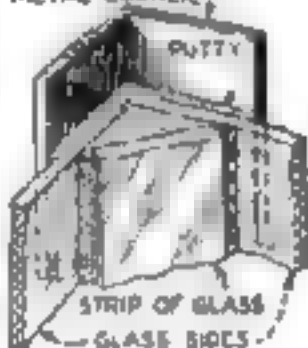
You will always have this information about chalk available if you will cut out the following label and paste it on the container or file it away among your formulas:

### Calcium Carbonate



**Precipitated** chalk for whiting is useful for making cements of various kinds. Mixed with water glass, it forms a cement for porcelain and glass. Mixed with raw linseed oil, it forms a putty for windows. When at least fifty percent of red lead is added to this putty and the entire mass made into a soft paste with the addition of raw linseed oil, the cement formed can be used for making pipes air-, water- and gas-tight. It is also well adapted for puttying glass in aquariums.

METAL CORNER.



Cemented joint for a square glass aquarium.

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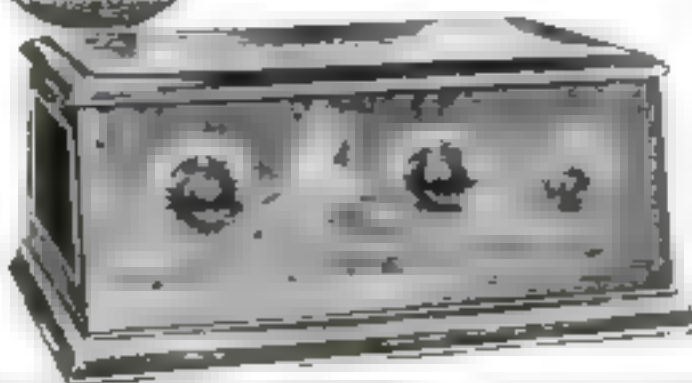
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## The Shipshape Home

### How to Replace Sash Cords

IT IS surprising how many persons have little or no practical knowledge of the mechanism that balances the ordinary double-hung windows which they pull up and down every day. Consequently when a sash cord breaks and the window fails to operate, they have to pay for the expensive services of a mechanic to do a job that can be done very easily by any home owner, whether man or woman. All



Fig. 1. The window stop is pried off.

the tools needed for the task of replacing the cord are a chisel, a hammer, and perhaps a screw driver.

A length of the best quality sash cord should be obtained before the job is begun. As a safe measure for length without having the old cord as a guide, use the distance from the window sill to the pulley, plus 8 in. Sash cord can be bought at any hardware store, and no substitute should be used. With the

cord ready for use, proceed with the work as follows:

Pry off the window stop with a chisel as shown in Fig. 1. This needs to be done only on the side where the broken cord is. If the cords should be in need of repair on both sides,

Cont. on page 99



Fig. 2. The cord is removed by raising it out of its groove with a screw driver.

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**\$25 IN PRIZES**  
See Cash Prize Offer on Page 114



## The Shipshape Home

### Replacing Sash Cord

(Continued from page 96)



Fig. 3. Removing the parting strip



Fig. 4. How the "pocket" appears

It may be necessary eventually to remove both stops, depending upon whether the stop covers the "pocket" piece, which can be seen in Fig. 4.

Next, pull the sash out at the side where the stop has been removed and slide it out of its groove at the opposite side. It is well to remember at this point that glass is now being handled. Do not make any abrupt or violent movements that might add the job of reglazing to the one already at hand.

The cord which is not broken must be removed. This is done with the aid of a screw driver or other sharp instrument as shown in Fig. 2, just pry the cord out of its groove. Sometimes it will be found that a shingle nail has been driven into the knot. This makes it somewhat harder to loosen. Tie a large loop knot on the cord before releasing it so that the weight will hang suspended in the frame with this knot against the pulley.

If the upper sash is the one needing attention, the "parting strip" must next be removed. That is the strip or stop against which the outside of the lower sash and the inside of the upper sash slide up and down. Sometimes this strip is tightly stuck in the paint and must be cut loose with a chisel or other edge tool as shown in Fig. 3. If this is not done it will tear the wood when it is forced out of its groove. (Continued on page 100)



Fig. 5. If the parting strip is stuck in its groove with paint, loosen it with a chisel



\$1.00



Aristocrat E-Z TOON  
Vernier Pointer



\$2.00

## The NEW "Aristocrat" Vernier Port Dial



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gift for the real man.

**E. C. ATKINS & CO.**  
Established 1877  
424 N. Illinois St.  
INDIANAPOLIS, U. S. A.

## Replacing Sash Cord

(Continued from page 99)

After the paint is cut, the strip is pried out carefully. When doing this set the chisel firmly in the wood (Fig. 3) and do not let it slip. Pull the upper sash down to the sill and loosen the strip from the top downward. Then lift the strip up to make it clear the "meeting" or lower rail of the upper sash. Now the sash itself may be removed by loosening the cords on each side as directed for the lower sash.

The "pocket" piece (Fig. 4) is pried out after the one or two screws which hold it in place have been removed. This piece is sometimes located in front of the parting strip and partly under the



Fig. 5. Tying the sash weight. A knot must be used that will never slip or loosen.

window stop. If it is located as shown here, however, the parting strip must be removed regardless of whether the lower sash only needs attention, since the pocket cannot be opened otherwise.

Inside in the opening thus revealed will be found the released sash weight—an iron casting.

Now tie a knot on one end of the new cord similar to the one found inserted in the edge of the window, and secure this knot in its proper place. Nail it if a nail was used in the old cord.

Put the window back in the frame and insert the free end of the cord in the open pulley. Push the window to the extreme top and if it will not stay there, fasten it with a wedge or have someone hold it. The loose end of the cord will probably be easy to find at the open pocket. If you cannot get the end of the cord in this way, pull it out entirely and make what is called a carpenter's "mouse," which is simply a piece of soft lead, chain or other small weight tied to the end of a string. Slip the weight over the pulley, tie the string on the end of the sash cord and pull the cord through.

Stand the weight on the window sill and while it is in that position, tie the cord last as (Continued on page 101)

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require no medicine but effectively replace what is lacking or defective in the natural ear drums. They are simple devices, which the wearer easily fits into the ear where they are invisible. Soft, safe and comfortable.

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## Replacing Sash Cord

(Continued from page 100)

shown in Fig. 6. This will leave the cord the correct length. Study the old knots for the type that will not slip.

All carpenters, of course, do not follow exactly the same method in doing a job of this kind, but the process as outlined is a good one for the beginner to follow.

The process of assembling the window is simply a reverse of the one already used. Take care not to drive long nails where they will interfere with the action of the weights. Care also should be exercised in nailing the window stop back in position. It is well to put nails in all the old holes just as a matter of covering the holes even if a few new ones must be used to add the needed strength.

It is not amiss at this time to examine the other cords to see if they are worn enough to require attention and thus save the trouble of having to do the job over again soon. EMANUEL E. ERICSON.

## PAINT TROUBLES— Their Causes and Cures

By BERTON ELLIOT

MRS. ANDREWS, our neighbor dropped in the other evening.

"I've been saving these for you," she cooed sweetly but with a roguish twinkle in her eye, as she unrolled a strip of paper that seemed about a yard long. "They're troubles."

"Troubles?" I repeated.

"Yes. I've been doing quite a bit of painting about the house lately, going ahead of my own record without asking any questions of anybody, and there have been things that didn't turn out right."

"Well, let's hear about them."

"I was doing one of the bedroom floors with varnish stain and it didn't work well at all. At other times it had been just as easy to use as anything, but this time it pulled and dragged under the brush. I thought I would never get through. And, besides, it didn't look very well either. The color wasn't nice and even. A big batch of color would stick in one place, and I would keep brushing away to spread it out evenly, but it wouldn't spread very well. When I got through the floor was streaked—dark in some places and light in others."

"A little turpentine was all that was needed," I answered. "Some of the liquids had evaporated since the last time you used the varnish stain. If you ever have any varnish stain that works that way again, just add some turpentine and stir it in well, and you will find your varnish stain working 'as smooth as butter' under a brush again."

Her next question had to do with the use of varnish. (Continued on page 102)



## Pathfinders

An advertisement of  
the American Telephone and Telegraph Company



CHRISTOPHER COLUMBUS discovered America, thus adding a new world to the old. Alexander Graham Bell discovered the telephone, giving the nations of the earth a new means of communication. Each ventured into the unknown and blazed the way for those who came after him.

The creating of a nationwide telephone service, like the developing of a new world, opened new fields for the pathfinder and the pioneer. The telephone, as the modern American knows it,

has been made possible by the doing of a multitude of things in the realms of research, engineering and business administration.

Its continued advancement requires constant effort in working upon a never-ending succession of seemingly unsolvable problems.

Because it leads the way in finding new pathways for telephone development, the Bell System is able to provide America with a nationwide service that sets the standard for the world.

**\$25 in Cash Prizes** See Page 114  
of this issue

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**14" Band Saw**  
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10" to 14" deep  
Saw cuts  
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Bronze Bearings.



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Does turning, drilling, heading, sawing, sanding, grinding and jet sawing in wood or soft metals. Swivel A 4 aparts 10 between 0 to 180.

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## Better Shop Methods

### Old Bill Tests a Lathe

(Continued from page 104)

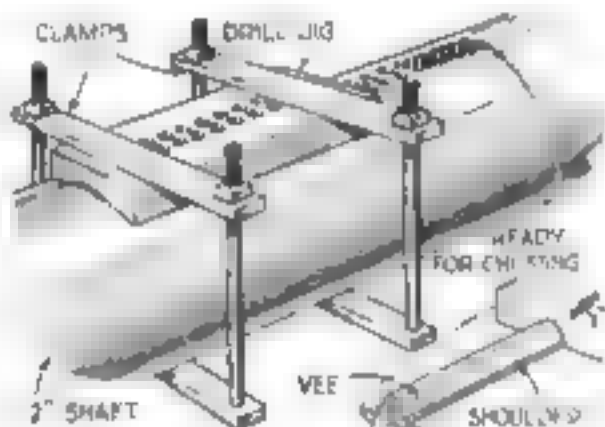
There was a shoulder on the vee where the carriage had been run back and forth. While this defect did not prevent the lathe from having a certain usefulness, Old Bill knew that it could not be depended upon to do highly accurate work.

"There are some other things in town I want to do," Old Bill told the proprietor, "and then I will be back to talk business with you."

"All right," he replied. "I shall be here all day."

Old Bill and Jones, the foreman, then took a turn about the shop by themselves.

"I have been wishing for a couple of days that I could see you," Jones remarked. "I have a job of the kind you like, and I don't know exactly the best way to get it done. One of the plants here has an engine driving a generator, and they have decided to put on another fly-wheel. There is room on the shaft, but there is no keyseat. The diameter is twelve inches, which means that we must



How the keyway was drilled through a jig the exact shoulder on the old lathe vee

do a lot of clapping, yet that is the only way I see that we can get it done.

"I don't believe I would chip all of it," said Old Bill. "Drill most of it out, and chip just to finish it. If you will get a piece of steel and make a jig, you will be able to do a nice job, and quicker."

"We can only get at the shaft for three hours a day, so speed is what we are after."

"Well, I can't say that you will be able to do the job in one day, or two," Old Bill continued. "But here is a method that will speed it up: Take a piece of flat steel and plane a vee on one side of it. Then lay off one-inch holes all over the area of the keyseat so that there is about an eighth-inch web between them. Clamp this on to the shaft and drill holes into the shaft all the same depth. Use a flat end drill to finish the bottoms. Now for the trick. Shift the jig along the shaft so that you can drill out the webs between the holes, and flatten these bottoms, too. Take off the jig, and all you will have to chip is a little on the bottom, and the high places off the sides."

"That sounds almost as good as a milling machine!" Jones exclaimed. "I knew that you would have some idea that would help me out on this job."

Old Bill started away on his next errand, happy in the thought that he could be useful to his "boys," even after they had left him and were no longer boys.

## He has good tools—his work shows it!



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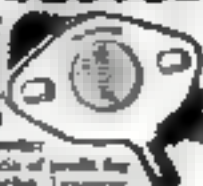
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## Better Shop Methods

### T-Square Guide Aids in Making Big Drawings

IN DRAFTING I often find it necessary to use the extreme right-hand side of my table, which cannot be covered conveniently or efficiently with the T-square. This is often the case in work-



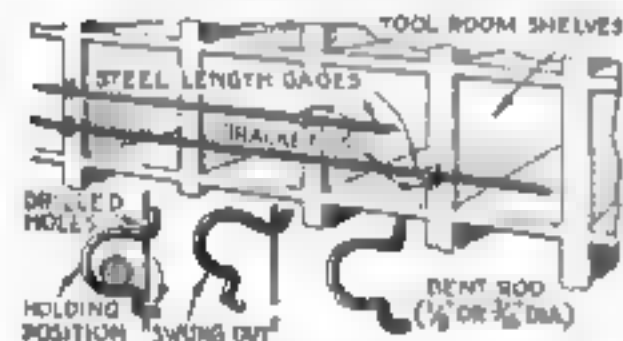
The guide bar is position for working at the right hand side of a large drafting board

ing on large drawings, therefore I devised the simple expedient illustrated.

For the crosspiece I obtained a well seasoned piece of  $\frac{3}{4}$  by 3 in. oak, while the two small wood blocks or "shims" are of any wood that may be at hand.

It will be noted that the T-square is used in an inverted position, and that the flat steel clamps form one means of adjustment in changing the position of the device at will.—L. J. MINURACA.

### Wire Brackets for Storing Long Rods and Gages

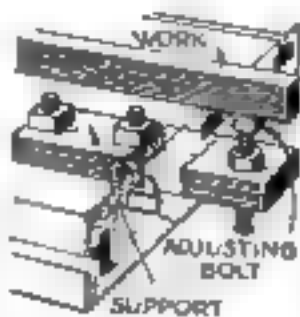


How the brackets are bent and inserted in the sheet steel shelving of the stock room

MANY shops use small rods for gages or length measures, yet it is difficult to store them without danger of bending them and destroying their accuracy. The illustration shows how small brackets may be fitted to the front of sheet steel shelving to hold the gages. The same type of bracket also is useful for holding a rail rod stock.

### Support for Long Machine Work

OVERHANGING pieces on the milling machine, shaper or planer table may be supported by means of a bar bolted to the machine table as illustrated. A bolt allows work to be lined up.—G. A. L.



The extension braces any overhanging part



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"Its remarkable selectivity and simplicity of operation leads me to believe it will be one of the season's most popular circuits."

"It is one of the easiest circuits to wire of any I have seen. Its engineering principle is sound."

"Congratulations to Bremer-Tully on this new development."

Bremer Tully has done more than design an extra good circuit and the parts to go with it—as Mr. Best says—"It is one of the easiest circuits to wire of any I have seen." B-T has made it easy to build. The parts are easy to buy—in a kit—and at less expense than if they were purchased singly.

Price of Power-Six Kit including essential parts, color diagram and instructions \$41.50

The full size colored picture wiring diagram and full instructions are also sold separately for \$9.00.

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### Better Tuning

The Tenth Edition gives detailed information on the Power Six. It also tells how to change the Counterphase to a Power-Six Model B-Eliminator, new Counterphase Eight and many general radio subjects covered. Sent postpaid on receipt of 10c.

**BREMER-TULLY MFG. CO.**

520 So. CANAL ST.  
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# Doctor Recommends This Tobacco to Pipe-Smoking Patients

There seems to be an unwritten law among pipe-smokers. When one man discovers a way to get more enjoyment out of his pipe, he feels obligated to tell the "pipe-smoking fraternity" about it.

So it is not surprising that when Doctor Gardner of Florida found a tobacco that really enabled him to enjoy a pipe for the first time, he made a point of recommending it to all his pipe-smoking patients.

You'll find his letter interesting.

Larus & Bro. Co.,  
Richmond, Va.

Dear Sir:

No harm done, I hope, if I feel like I want to say a word of praise for Edgeworth Ready-Rubbed.

I have tried many kinds of tobacco in a pipe, but until I got to smoking Edgeworth I never really enjoyed a pipe.

Frequently I say to patients who must smoke: "If you're going to smoke your pipe, use Edgeworth."

I like it and recommend it whole-heartedly to anyone who enjoys smoking.

Yours truly,

W. D. Gardner, D.O.

Let us send you free samples of Edgeworth so that you may put it to the pipe test. If you like the samples, you'll like Edgeworth wherever and whenever you buy it, for it never changes in quality.

Write your name and address to Larus & Brother Co., 10M S. 21 St., Richmond, Va.



We'll be grateful for the name and address of your tobacco dealer, too, if you care to add them.

Edgeworth is sold in various sizes to suit the needs and means of all purchasers. Both Edgeworth Plug Slice and Edgeworth Ready-Rubbed are packed in small, pocket-size packages, in handsome humidor holders a pound, and also in several handy in-between sizes.

To Retail Tobacco Merchants: If your jobber cannot supply you with Edgeworth, Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plug Slice or Edgeworth Ready-Rubbed for the same price you would pay the jobber.

On your radio—tune in on WRPB, Richmond, Va., the Edgeworth Station. Wave length 256 meters.

## Better Shop Methods

### Secrets of Boring

(Continued from page 72)

don't give you all you ask for. You see, it makes a great deal of difference whether you are roughing or finishing or whether you have a casting with scale in it or a plain piece of metal without scale. Also, the length and diameter of the hole and the machine you are using make a difference in the selection of a tool.

"NOW, take cast iron and bronze with cored holes—tools for those materials should be shaped as I showed you this morning, so as to get under the scale. Look at this sketch"—and he rapidly made the drawing shown in Fig. 2. Here are two views of a rough boring tool for cored holes in cast iron or bronze. This is a forged tool, but the grinding would be the same if tools were in a boring bar. Now, notice the front edge of the tool has a back angle of five degrees or less. The clearance below the front edge is as shown by the dotted line. The clearances should be as little as possible and there should be no rake on the upper flat edge of the tool although it may have five degrees or so in the direction D. Now, a finishing tool for the same kind of material could be round nose as at E with clearance angles about the same as for the roughing tool. A little land (F) right behind the cutting edge gives a smoother cut and prevents the tool from digging in."

"What about tools for steel and aluminum?" asked Harvey. "They should be 'hipped,' shouldn't they?"

"A GOOD way to think of the cutting action is to consider the quality of metal, Harvey. Any metal which forms a long or curly chip in cutting should be worked with a tool having a lip, as you call it, so that it will separate the fibers of the metal easily. Aluminum and steel both have long grain and hence the tool should be ground so the chips will curl off as at H. This form of tool gives a clean cut and does not tear the metal. The clearance angles must always be great enough so there will be no drag.

"What is the angle for the lip?"

"That is important. If you have too much back angle or side angle, the cutting edge of the tool breaks down quickly and the tool is also likely to dig into the work and chatter. Generally, for steel and aluminum or other soft metals, the back slope K should be eight or ten degrees and the side slope D fifteen or twenty degrees to give the best cutting action. You will find it an advantage to keep as close to these angles as possible when grinding your tools. I would use a protractor if I were you."

"All right, but I don't like to appear too fussy. Most men judge by the eye."

"If you are 'fussy' and this helps you to produce more and better work than your neighbor who is not 'fussy,'" Grimes commented drily, "I would say that you can afford to do it. Don't you think so?"

"I guess you're right," Harvey acknowledged as he said good night.



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### Speed Way Shop and Tools

A complete method of working out for men who are interested in "hobby" men. Driven or Motor Speed Way and Tools quickly and cheaply.

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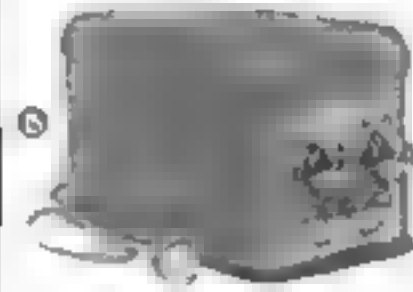
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## Better Shop Methods

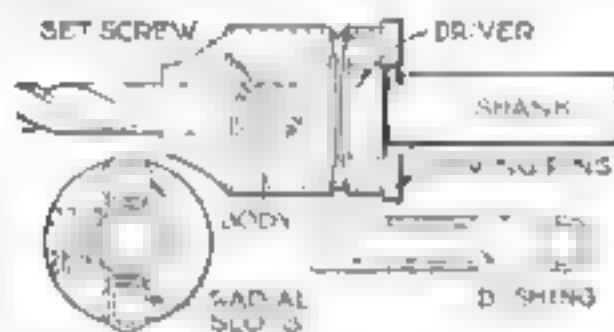
## Wobble-Joint Holder for Small Drills

By HENRY SIMON

**F**AULTY alignment in drill presses is a common defect. When drilling in small jigs this fault often causes the jig to shake or vibrate, if it is not secured to the drill press table. Clamping the jig to the table does not always provide a remedy, because the misalignment still exists and is apt to manifest itself in poor work and increased wear on the drill bushings.

The wobble-joint drill holder illustrated has been found to do good work in cases where the smaller sizes of drills are used in production drilling.

The device consists of a body, in which a set screw engages a flat on the shank of the drill, and a driver, which is formed with a flange corresponding to the body. The shank of the driver is held in the drill chuck. Both driver and body have slightly hemispherical contact surfaces and are linked by headed driving pins. These are driven firmly into holes in the body and engage in radial slots in the



The holder consists of two parts which have slightly rounded contact surfaces.

driver head. The slots are deep enough to allow a shake of about  $\frac{1}{32}$  in. either way, and the driving pins are set down far enough to space driver and body away from each other by slightly more than what is necessary to compensate for the perpendicular error. As a rule, from .003 to .01 in. will be sufficient. The slots are made wide enough to accommodate the full diameter of the driving pins, and the pins are slightly flattened sidewise to give a better contact and allow some side play in the slots.

It should be noted that the driving pin holes go clear through the chuck body to allow the pins to be knocked out or adjusted easily.

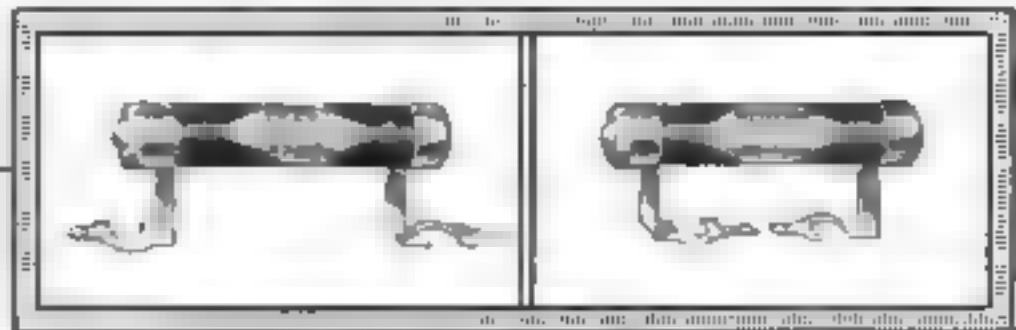
Several sizes of drills can be used in the same holder by the use of reducing bushings.

All parts of the chuck should be made from tool steel and hardened. For the body at least, it is best to use a non-shrinking steel. The drawing temperatures suggested are 360 for the body, pins and reducing bushings blue for the shank, and 450 for the working jaws.

In using the device it should be remembered that the drill press spindle assembly can be out of parallel alignment only one way. It should be ascertained which way it is out and the holder set to act approximately in the direction of the error.

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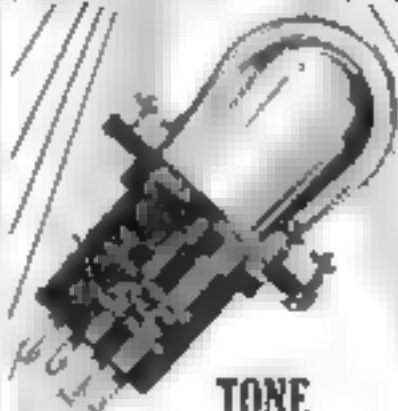


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## Do Our Athletes Equal Stars of Old?

(Continued from page 10)

longer and be much more efficient. All that is necessary is to sit quietly for a few moments, allowing every muscle of the body to relax. This gives the blood its chance to carry off the poisons thrown off by the muscles while they are tensed. It is one of the easiest things in the world to do, but for some reason very few men will do it.

"I'm afraid that we have wandered away from the subject of our talk—whether the college athletes of today are as good as were the college athletes of twenty-five years ago. As I said before, I don't think that there is any difference in the great athletes—the exceptional men. But in one way at least the present college student is far ahead of the students of earlier days. A much greater number take an active part in athletics. Of the 4,000 men at Yale, 3,200 participate in some form of sport. The athletes of today may not be better than were the athletes of twenty-five years ago, but certainly there are more of them. That is a healthful sign.

"THE physical training value of the different sports varies. Football, for example, has little physical training value, for most of the men who play it already have well-developed bodies. But for moral training it is unequalled. The football player learns to get up and go on fighting after he has been knocked down hard, and to go on fighting without feeling any animosity against the man who knocked him down. Can you think of any better training in moral and in the practical sportsmanship that is needed so badly in business, political and professional life? I can't.

The students at other universities are as keen on active participation in sports as are the students at Yale. Of the 617 young men who entered Princeton last fall, 611 are taking an active part in some branch of sport. Among the upper classmen, last fall 250 men played in a 'touch football' league composed of thirty-two teams. Touch football by the way is football without physical contact, except when the player with the ball is tagged.

NOT long ago, I asked Ernest W. Hyerberg, now track coach at Rice Institute, in Texas, and formerly coach of Swedish and Dutch Olympic Teams, how the present-day athletes differed from the athletes of the past. "They aren't willing to train as hard, if you are talking about American athletes," said the widely experienced Hyerberg. "Most of our athletes, especially our runners, are undertrained. That's why we made such a poor showing in track events at the last Olympics. The Finns and the other European athletes are made by hard, grinding work in training. Why, Nurmi has done more running in training than has been done by any dozen average American runners.

A glance at the American amateur running records shows that only a few of them have been on the books for twenty years or—(Continued on page 112)



## Do you hear *All* of the Orchestra—or *only part*?



WHEN famous orchestras broadcast, do you clearly hear all the musicians? Or—through inability of your transformers to amplify low and high notes as evenly as middle tones—are you really only listening to a few of the instruments? Put Jefferson "Concertones" in your set and enjoy the whole orchestra!

Specified in latest circuits because they do not lose, distort or "blat" any audible notes from the lowest (30 cycles) to the highest (10,000 cycles). Ideal for sale, continuous use with power tubes. At your dealer's, \$6 each.

JEFFERSON ELECTRIC MFG. CO.

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# Jefferson

## Concertone Transformers

## Make More Money

Read the Money Making Opportunities on pages 114 to 142 of this issue.

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285 Cass Street

DAVENPORT, IOWA







## Wonders of Everyday Things

(Continued from page 10)

pended raindrops. So, at the same moment, a race starts. The lightning flash, the noise of the thunder and the falling rain all start earthward together. The light travels 186,000 miles a second and gets in first. The thunder is more sedate and rumbles along at 1100 feet a second. The rain dawdles down at only twenty-five feet a second, so it reaches earth long after the thunder and lightning.

It doesn't always rain after battles, either we learn, or on the Fourth of July. Battles are often fought in good weather, so naturally are followed by bad. Analysis of weather reports for ten to forty years before the Fourth became safe and sane shows that the day averaged neither wetter nor dryer than the days before or after. So there's no use, it seems, making a noise to start rain.

Mr. Humphreys has studied various means to produce changes in the weather and he thinks they are all "the bunk," including the new idea of sprinkling electrified sand or liquid air from airplanes. Likewise the Californian experiment of stretching electric wires. Rainfall in California is still substantially the same, he says. There is no way to control rain.

If you flatter yourself that you haven't any foolish ideas about weather, Mr. Humphreys will soon disillusion you. The moon does not control weather, he declares, except that there are sometimes slight changes in surface temperature on some straits and coasts when tidal changes have brought up a mass of cold water. Neither does the dew fall. It comes from adjacent air or comes from grass.

### "Twenty Years in Borneo"

By Charles Bruce, Frederick A. Stokes Co.

THEY celebrate New Year's Day in Borneo by shooting poisoned darts from blowpipes at targets representing human heads.

The blowpipe, called a "sumputan," is a deadly weapon. It is a six-foot tube of hard wood, an inch or so in diameter, with a handmade bore of about a quarter of an inch, so accurately bored that it looks like machine work. The darts are made of the rib of a palm leaf, fitted at one end with a plug of pith to fit the bore and sharpened at the other. The point is steeped in poison the composition of which is secret, but which, if fresh, causes death in five or ten minutes. Mr. Bruce, as he tells us in *Twenty Years in Borneo*, used an old dart on a monkey that was running amuck, and two minutes later the monkey dropped from a rafter to the ground and died almost immediately.

This poison is thought to be made partly from the upas tree juice. There is an antidote, but it is also a secret; the only way to avoid death is to excise the tissues about the wound.

In the New Year's Day shooting match, all the dark gentlemen who competed had to discard trousers, "chawats" or loin cloths being the uniform required by the rules. Yet civilization seems to have made some progress in Borneo, to judge from Mr. Bruce's interesting book. The head-hunters still hunt heads occasionally, but pretty far in the interior.

# VICTOREEN SUPER COILS

## Guaranteed Precision to 1/2 of 1%

That's why Victoreen coils are so sharp tuning—that's why a Victoreen Super set is without a peer among radios. Victoreen Super sets are free from oscillations, howls or squeals—no matching of tubes is necessary. Range, clarity, volume, selectivity and ease of operation are all Victoreen features.

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#### Use These Parts in Your Set:

- 4 Victoreen No. 176 R. T. Transformer
- 1 Victoreen No. 116 Coupling Unit
- 1 Victoreen No. 126 Antenna Coupler (for use with outside aerial only)
- 2 6-ohm Victoreen Rheostats
- 2 30-ohm Victoreen Rheostats
- 1 400-ohm Victoreen Potentiometer
- 1 Victoreen Master Control Unit
- 1 Victoreen Audio Amplifier

#### Victoreen Master Control Unit



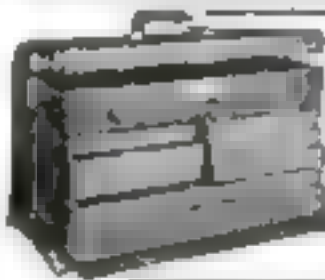
A completely assembled unit with all the essential parts called by a complete set of Victoreen coils which are made for the satisfaction of the radio enthusiast. The unit is built with the best of materials and is a real work of art. It is a complete unit and can be used in any set of Victoreen coils. Any change of wire is made.

Free Victoreen folder and hook-up answers all questions about Victoreen circuit.

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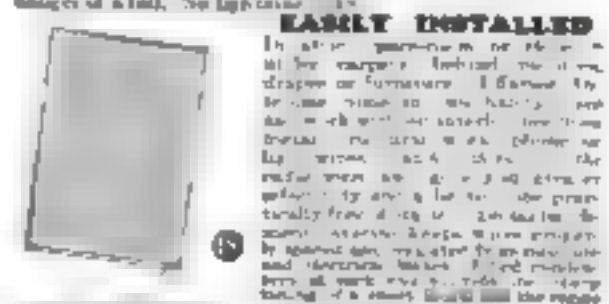


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Neither due to fear of the new and strong clear reception. No danger of a fall. No lightning bolt. No danger of a fall. No lightning bolt.

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Cabinet Shop  
Special  
No. 10  
\$290  
with Motor



You ought to have this handy Parks in your shop. It is a compact, complete machine designed just like a big production outfit at one-fifth the cost. Includes 8-inch circular rip and cross cut saw with polished cast-steel saw table, 16-inch band saw with tilting table for bevel-sawing, 6-inch jointer and motor operating from any light socket. Just plug in and go to work! Fits in a corner of your basement. Does any kind of cabinet and joinery work. Add lathe, shaper and other attachments any time at small cost. For the man who does "odd jobs" in his off time this Parks is a big money maker. Turn out as much as a four-man shop working by yourself.

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**12  
Weeks**

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**Earn  
Up  
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\$200  
per  
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Get PRACTICAL  
Training in the  
Great Shops of

**COYNE**

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## You Can Earn More in Electricity

Get training in the Clean, Fascinating Profitable Field of **ELECTRICITY**. **COYNE Trained Men Are in Demand**. Here's a proposition that should arouse the enthusiasm of every red-blooded, ambitious fellow. Why not make this your happiest and most profitable season? Come to Chicago, the great, interesting city and place of big opportunities. I'll pay your railroad fare here, and you can prepare yourself in 12 happy weeks at **COYNE ELECTRICAL SCHOOL**, to join the ranks of successful big pay men. Why gamble on other lines of work when the field of Electricity offers millions of amazing opportunities?

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I have started thousands of men, young and old, on the road to success and independence. I can do the same for you. I teach you everything in

Electricity from A to Z, by practical instruction. Nothing that will help to make you a success is left out.

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I can teach you electricity in 2 weeks, regardless of your education or experience because I teach you every detail in a simple, logical, PRACTICAL manner, letting you work out problems on thousands of dollars' worth of modern electrical apparatus in my great **COYNE** shops. My instructors are trained men with years of experience.

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Chicago is the greatest electrical and industrial center, therefore it presents real opportunities for you. Along with my shop training you visit

the big industrial organizations and power plants and see every kind of electrical equipment in operation, on every kind of job, under all conditions.

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Right now I am making one of the greatest offers ever made by a Practical Training Institution. My offer includes **FREE RAILROAD FARE** to Chicago from any place in the U. S., also extra special **FREE Dinner and Room**. Be sure to send the coupon **AT ONCE**, even if you are not planning to come immediately.

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**ELECTRICAL SCHOOL**

Founded 1899—27th Year

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## \$25 in CASH PRIZES

For the best letter of 170 words or less answering the question—

"What advertisement in the 'Money-Making Opportunities' Section interests you most—and why?"

we will pay on February 10th the following—

#### CASH PRIZES

First Prize	\$10.00
Second Prize	5.00
Third Prize	3.00
Seven Prizes of \$1.00 Each	7.00

First read every advertisement in the Money-Making Opportunities Section on pages 114 to 142. Pick out the one that interests you most and then write a letter—not exceeding 170 words—telling us why you find the advertisement you have selected the most interesting.

Entries for the contest will close on January 3rd. The prize winners and their letters will be published in the March issue of **POPULAR SCIENCE MONTHLY**.

Address your letter to

Contest Editor

**MONEY-MAKING OPPORTUNITIES**  
**POPULAR SCIENCE MONTHLY**  
250 Fourth Ave., New York

#### PRIZE WINNERS

in the November Contest

##### FIRST PRIZE \$10.00

Raymond Black, Spokane, Wash.  
National Salesmen's Training Assoc.

##### SECOND PRIZE \$5.00

Victor Dyer, San Francisco, Calif.  
American School

##### THIRD PRIZE \$3.00

Sorchi Nakagawa, Kealia, Kauai, Hawaii  
National Radio Institute

**PRIZE WINNERS who receive \$1.00 each for their letters**

Rev. Raymond Bornek, Pulaski, Wis.

Washington School of Cartooning

T. M. McEwen, Springfield, Mass.

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Thomas P. Smith, New Orleans, La.

Sherrill Coyle, Belmont, England

Marcy C. Brown, San Jose, Calif.

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Mr. Cooke: If it had not been for your Course I would still be plugging away for \$3 a day. Instead I have all the work I can do and my earnings run as high as \$23 to \$26 a day. I owe all my success to your training. Edward A. Lehmann, 1521 Market St., Oakland, California.

# They Know How to Get the Big Pay

**Will You Learn the Secret of Lehmann's and Hines' Success? Mail Coupon for Free Book That Tells All**

**\$26  
a day**

## \$85 a Week —and Going Up!

Dear Chief: With your Course and your great help and encouragement I am going right over the top. I am making \$85 a week now and it is going up. I had only a common school education when I started with you and now I have experience. Your lessons were easy to learn and I owe my success to you — R. M. Hines, 1701 Aberdeen St., Chicago Heights, Ill.

IT sounds too good to be true—it's hard to believe—that thousands of men like the two pictured here could step out of small pay, no future jobs and earn \$3500 to \$10,000 a year in Electricity. Yet that's just what many hundreds of men have done. Most of them had no previous experience—all of them kept right on with their regular jobs and used spare time only, to prepare for the big-pay jobs they hold.

What was "the something" that brought these men big-pay and quick success? What makes it possible for them to earn from two to four times more than you are able to earn working hard every day? They couldn't have used ordinary methods because other men who tried them have failed. They must have gotten hold of something new—something different—something that matches electricity itself. And electricity, you know, is the world's greatest business.

No matter what any man has done about his training, you must realize that if you are doing now—you owe it to yourself to find out the secret of the big pay. It is the secret of the big pay. It is the secret of the big pay. It is the secret of the big pay.



**L. L. COOKE**

He is Chief Engineer of the Chicago Engineering Works, Inc., and has trained and helped hundreds of men into big-pay Electrical Jobs.

Chief Engineer Cooke has prepared a wonderfully interesting book printed in colors with 64 pages and over 100 pictures, telling all about electricity, the opportunities it offers young men and what these opportunities mean to you. This is the same book that started so many other men on the road to big pay. It's free and it may help you like it helped them. Anyway send for the book and decide for yourself. There is no obligation on your part and no agent will call on you. Mail the Coupon Now, to—

**L. L. Cooke, Chief Engineer**

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**L. L. Cooke, Chief Engineer**

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Send me your free book about Electricity and proof that the men you have trained are holding big pay jobs. I understand no agent will call on me and I won't be obligated to take your Course.

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**\$85  
a week**





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## Get this Million-dollar Institution back of you!

Three powerful services here *Training*, to prepare you. *Employment*, to place you. *Consulting*, to help you win promotion and increased pay.

You can get ahead faster with *training plus practice* than by "experience" alone. You'll find it *easier* to get a good job and *keep it* with this great school to recommend and advise you, than going it alone!



O. C. MILLER

Director Extension Work

I represent the interests of our thirty thousand student. My job is to see that they get what they enroll to get—preparation for a better job, then help in finding it.

## Go to School at Home

The AMERICAN SCHOOL is one of the largest in America, serving 30,000 students each year, *in their own homes!* Chartered 30 years ago as an educational institution, *not for profit*, like the best resident schools and colleges. If you were denied specific training for your chosen line of work, look into this opportunity to secure the very finest kind of instruction, prepared by over 200 noted engineers, educators and executives.

# A Better Job!

## Bigger Pay

Read my refund Guarantee:

Right in your own home, in spare time, at a cost easily within your reach, we undertake to give you the *specialized training* that you need to get ahead. Even if you lack confidence in your own ability to master the necessary instruction, **WE DO NOT.** If you are now earning \$40 a week or less, if you have common schooling or better, we will prepare you for a position paying at least 50% more than you earn today within 60 days after you finish the training or *refund your money.* Our money-back guarantee relieves you of all worry and risk.

assures you of getting all the benefits you expect to derive from your training.

## I want to send you White Magic FREE!

Here's truth stronger than fiction. True stories (hundreds of them) told by AMERICAN SCHOOL students and graduates. The *traces* to get ahead. Success and in the face of bitter difficulties. *White Magic* will make you say — "It's true!" I can, too. Read the coupon, bring it FREE!



## Guaranteed Training

—the sure way to success!

If you've reached the point where you're wondering about your future in your present job and line of work — if you've come to see that a man must educate himself for some *one special line* if he expects to earn money enough to enjoy the good things of life. If you're tired of hard, monotonous work at small pay, and feel that *with training* you can make as much money and as rapid progress as *anybody*. If you're wondering if **YOU** can break into Electricity or Drafting or some other well-paid line of work where there are real opportunities for promotion—*then get in touch with me immediately!* I will tell you how the AMERICAN SCHOOL will guarantee to help you make good in the line you choose.

O. C. Miller, Director Extension Work

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The Great Hindoo Mango Tree Illusion  
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So amazing, so mystifying is the Magic power of this great Master, Dr. Harlan Tarbell, B.Sc., F.S.D., D.N., that Europe called him "the miracle man". AND NOW—think of it!—YOU have the marvelous opportunity of learning these Magic Secrets—at home—by mail—direct from this great master. You'll be astonished at how, through the able teaching of this great Master, YOU will soon master—impromptu effects, parlor tricks, and even massive stage illusions. You'll be taught famous mysteries of Europe, China, and of the Ancients. Great secrets will be revealed to you.

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Yes, even those great mysteries the Hindu Fakir guards so jealously—all this and MORE will you be taught and soon master with this great renowned teacher who mystified Europe and whose original ideas are used by famous magicians the world over. The great Dr. Tarbell will initiate you into the innermost mysteries of this time honored profession. Your friends will be amazed at the great Magic Powers you will soon acquire. Your friends will envy you. Magnetic popularity will be yours.

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There's big money in Magic for YOU. Yes, and the best part is that you do not have to give up your present position or business. You can make nice money entertaining on the side, or under the guidance of this great Master, you can become a real, professional magician, make big money and enjoy fame and glory.

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**Surprising New Invention Upsets All Established Shaving Traditions And Methods. Makes Any Kind Of Safety Razor Blade Last For Months And Even YEARS. Gives You The Keenest, Slickest Shaves Of Your Life And Cuts Shaving Costs 83%. Special FREE Introductory Offer. Act At Once!**

# No More Blades to Buy!

**H**ERE is the most remarkable invention in the history of shooting. I think such a radical solution is now being sought and no man has succeeded in his search more than I have. In 1945 I killed in a single afternoon a whole regiment of German soldiers. I struck a new kind of bullet into every eye. I shot in the back of heads, neck blades, stomachs where they are weak but are still going to soon killed. It is my friend, in a very much needed uniform in the form of your hand and head. In our army community you will never know to a really successful that this is the best of

### Made Diamond Struts

THE HUMAN STRIKE begins as a further note. Never before has anyone captured the spirit of universal sympathy by striking his strike and making his point in a way that is so simple and so effective. The trick is a two-fold one. It is essential that a quarter of a century ago, to a man, human beings have their off-days, but NILES-KROHN is on he goes with unvarying regularity 7 days a week and 24 hours a year!

But that's not all. KR100's 10,000 embosses and another feature that has taken the "million mechanical reproductions" is a strong arm lever on the left. It absolutely shines. He says the strokes start with strong pressure and grow lighter and lighter until an adjustable attenuator (the

Wipe up and notify you that your blade is ready—  
ready with the brand new no-nonsense steel on tape!


### 349 Shares A Year From One Blade

No wonder that his injury disrupts everything the life of any center is the struggle to find a way to work, months and years. No more better about

remembering to buy new blades. No more knives with dull edges. No more cutting and squaring his hair. He relaxed with funny books and harsh criticism of his children grown up. Each year, day after day, turning good. Every minute with KATHA, JEFFREY, and just love his the whole, here and edge that ever and good. Manner of just than. And you, there are, felt we are a time to find that, once you did, he took. All too late. So when a our blade position. For all time here, we've smooth shapes forever. And think of the country.

### Residential Offer

And now for my surprising  
offer. To introduce to all  
Kluge's a group who have  
not yet seen. I am sitting  
with it from a new point of



## Mystery Razor Free To Every User

Must ask nothing more you ever saw. Real 3 color in one. Adjustable to any viewing position. Micro feature reduces beautiful resolution 40% and simply goes through the roughest crop of whiskers. Nothing like it ever on the market before. I want you and FIVE to introduce KISS-KISS super-slims. Limited offer. Find out about it today.

finger. Powerwin retaining  
feature. Instant adjustment  
to any desired position. A flip  
of the finger makes it 1)  
T-tube, or straight style.

(3) *not* diagonal (new way). Given a sliding instead of pulling exercise. Mainly slip right through and tug back or give a sideways and loose joint from back-strained with a good use of force of the apparatus and so swing. A lot of freedom motion. A little extra force and nothing is possible if you are up. For every use like anything is a new way before.

His first work on human hair came from a 1960s advertisement for hair products, attached with a blacked-out stamp. He says, "I thought you found five years to a lifetime, so I just exaggerated." A 1961 article by a *Life* magazine writer that he has used on the hair page, discussing hair loss, said "a year ago, 10 percent of 19-year-olds had over 2 years' shaves from a woman's hair and over a fifth shaggy." He points to another report, 1, 2 and 3 years of hair shaves from the same model. "Totally accurate."

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Meted for full character on an three different new in-  
volved new design. The first full new principle is new space  
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and full design. The fourth design is a new space after  
markable and a new full in a thin about space. The  
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**AGENTS** MANY EARN \$190  
A WEEK AND UP

1. The first step in the process of the investigation is to determine the scope of the problem. This involves identifying the specific areas of concern and the potential causes of the problem.

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Rhodes Manufacturing Company **STROPPER**

**Largest Manufacturers of Mechanical Stoppers in the World**

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**1418 Pendleton Ave., St. Louis, Mo.**







## How the Movie Camera Lies

(Continued from page 17)

feet away, recorded was a stirring picture of a battle fleet in action, realistic enough to bring patriotic hysteria to the thousands of potential Navy recruits who thought they were seeing the actual engagement. This identical method is still in use—for depicting floods, fires, shipwrecks and similar catastrophes where the destruction of actual houses and ships is too costly even for the movies.

Who said the camera never lies? You know that a picture of two friends shaking hands will, if the flasher has printed the film wrong side up, show them with their left hands clasped.

IN "THE Ten Commandments," the waters of the Red Sea were seen to part to let the fleeing Israelites pass through—only to close in a gushing cataract upon the pursuing armies of Pharaoh. This spectacle was obtained by double exposure. A part of the picture, later to contain the fleeing tribes, was blocked off. Then a scene was made showing water rushing into a glass-sided trough from the sides above. Two records were made of this, the first with the camera cranked backward. This represented the parting of the waters; and the other, their closing again. Now the film was again exposed, this time with the water scenes blocked out, and the armies marching on dry land—as well they might for there was no water anywhere near them.

A comedian walks rapidly across the scene. You can see he is in a tremendous hurry, for his feet are moving as if he were on a spinning treadmill. So he was. A black velvet drape concealed the background when the treadmill effect was filmed, and the finished background—a street scene shot from a rapidly moving automobile—later substituted. This type of combination picture requires no great skill, for the fast motion obscures the faking.

A GREAT deal more difficult is the process that enables actors to double for themselves in a picture that may contain two characters of mutual resemblance; when, for instance, an actress appears in the same scene as mother and daughter. "But I know how that's done," you say. "They take half the picture at a time, and each character stays on one side of the picture." True, and right you are. But suppose they don't? Suppose mother and daughter meet in the center of the picture for a fond embrace? That happened in a recent picture.

The answer, as in most clever illusions, is simple enough. At the moment of the embrace the camera was stopped and another actress was put in to take the place of one of the characters. She kept her back to the camera and the few moments of action did not leave time for the artifice to be discovered.

As mentioned before, the camera has no sense of distance. The effect of nearness or of farness depends entirely on the ordinary effect of perspective. If you see on the screen one big house and one tiny one, your (Continued on page 124)

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## How You Catch Colds

(Continued from page 32)

You have only to shampoo your hair and leave it wet for a time to experience enough stiffness in your nose to make it necessary to breathe through your mouth. Riding in an open trolley on a windy night without a coat or walking through melting snow without galoshes may cause the same discomfort. But mostly this nasal tightness is not deserving of the name of a cold. It lasts only a short time, after which the nose is as healthy as ever before.

**T**HE probability is that exposure to cold, dampness and drafts does play a rôle in the onset of a cold, but only a subsidiary one. Cold and wet applied to the body, it has been shown, diminish the amount of blood supplied to the nose. And a diminished blood supply means less resistance to microbes. Thus whatever part exposure plays in causing coryza partakes of the nature of preparing the nose for the invasion of the germs, rather than of causing the cold itself.

Hot drinks and hot mustard foot baths are familiar old-fashioned remedies for colds, and undoubtedly their popularity is deserved. Sweating is a time-honored remedy, and is quite effectively induced, also, by hot lemonade and scorching hot baths. To these extreme treatments we may add steam, medicated with turpentine or compound tincture of benzoin, inhaled through the nose and brought directly to the seat of the disturbance.

The proper thing to do for a cold of any degree of severity may be expressed pithily in three sentences: Stay home. Stay in bed. Send for the doctor. The person who obeys these instructions will not be guilty of spreading his microbes all over his fellow men and will, at the same time, be doing his best to avert serious complications in his own case.

## The Captain's Car

(Continued from page 117)

just removed. "Look, it's full of dirt and the dirt interfered with the flow of gasoline. I'll clean it out and the one on the vacuum tank, and then blowout the gasoline pipe with compressed air. She'll run fine after that."

But the motor refused to start. In fact the young repair man wasn't able to get a single explosion out of it.

"That's strange," he said. "Maybe it's one of the valves. I'll look 'em over. And he took off the plates that covered the push rods. While the captain pressed the starter pedal, the young man watched the valves carefully. They moved up and down perfectly. A test of the compression was his next step.

"The compression doesn't amount to much," he observed, turning the motor over by hand a few times. "Still, I never saw a motor stop just because the compression was a little weak. It's just as good in one cylinder as another, too."

By this time the young man had lost his swaggering assurance. "It's got me licked," he confessed humbly. . . .

What was wrong with the captain's car?

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In this field, too, it has been learned that music must be selected with care. An intensive study of the subject has just been completed by Dr. James Ewing of Cornell University, noted authority on cancer treatment, among his patients in the New York Memorial Hospital. He made many measurements of pulse, temperature, respiration and blood pressure among patients under musical influence.

The results (Continued on page 151)

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## The Power of Music

(Continued from page 116)

proved that the kind of music which may benefit one patient may injure another. For example, a brilliant selection was found dangerous to a patient with high blood pressure, whereas it stimulated another patient with low vitality. Pleasing music of moderate rhythm, however, played for short periods at a time, was found generally beneficial to nearly all patients.

**M**ANY instances have been reported where music has been employed to relieve pain and to act as an anæsthetic. At the Providence Hospital in Washington D. C., phonographic music is played softly in the operating room to soothe the subconscious mind of the patient under anæsthetic. In Chicago not long ago an operation was performed on a patient's eye without any anæsthetic. Instead a violinist played soft music during the half hour of the operation. At the conclusion the patient said that she "felt no pain and the music was beautiful."

Again Dr. W. E. Dentiger, a Connecticut practitioner, declared not long ago that Vice-President Charles G. Dawes, when he wrote his "Melody in A," provided "just the tonic for hysteria." And Schubert, he added, when he composed the immortal "Serenade" conceived a blessing for the nervous patient.

Undoubtedly other factors besides rhythm have a part in giving music its power. Among them are the loudness, or volume of the sound, the pitch, determined by the rate of the sound vibrations, the timbre, or tone quality, the tempo, or characteristic movement, accent, cadence, harmony, and so on.

Many of us have had the experience of being "raised off our seats" by the very intensity of musical sound. Curious as the story goes, could strike a drinking glass, repeat its note with his voice, and continue to sing that note until the intensity of vibrations shattered the glass. Is it any wonder, then, that some blasts of music can send shivers down our spines?

**A**S FOR pitch, we know that certain tones are more pleasing than others and that some are decidedly disagreeable. A woman's piercing scream, the shriek of car wheels, the hiss of the villain—all are sounds that "hurt" our ear or affect us unpleasantly, because their vibration frequency is higher than our ears like to hear. On the other hand, low rumbling organ tones are displeasing to many people.

To get the whole story of music, as was suggested the other day by Prof. Michael L. Pupin, of Columbia University, "we must follow the sound vibrations through that marvelous receiving instrument, the ear, which with its sixty thousand parts speeds the message along myriads of tiny nerves to the central station, the brain. There the soul of man interprets the language of music."

Perhaps, when we understand this language more fully, we shall find undreamed of uses for the vast streams of music which fill the air and which most of us now regard as little more than passing pleasure.

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## Lifts Income 400% Accountancy Training Pays!

"Today my earnings are 400% larger than when I started with LeSalle Extension University. I was employed as a clerk. I realized the necessity for increased efficiency and entered with LeSalle Extension University. After I received a position as Junior Tax Collector and Manager of a large corporation with an income of \$10,000. In 1911 I was in a business for myself. In my opinion, the LeSalle plan of study is the sure way to success."

Two books—"Accountancy the Profession that Pays" and "Ten Years to Making a Million Dollars." Mr. Yalen the loss of a job is a setback in the world progress in the accounting field. LeSalle Extension University has a free copy of "Accountancy the Profession that Pays" and "Ten Years to Making a Million Dollars" for you.

### LESALLE EXTENSION UNIVERSITY

The World's Largest Business Training Institution

Dept. 183-HR Chicago  
I should begin to have details of your salary-doubling plan as applied to my advancement in the business field checked before. Also a copy of "Ten Years to Making a Million Dollars" and "Accountancy the Profession that Pays" will be of great value.

Higher Accounting

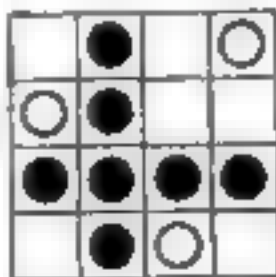
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| <input type="checkbox"/> Modern Stenography         | <input type="checkbox"/> Modern Foremanship and Production Methods   |
| <input type="checkbox"/> Traffic Management         | <input type="checkbox"/> Personal and Employment Management          |
| <input type="checkbox"/> Railway Station Management | <input type="checkbox"/> Expert Bookkeeping                          |
| <input type="checkbox"/> Law Degree of LL.B.        | <input type="checkbox"/> P. A. Coaching                              |
| <input type="checkbox"/> Commercial Law             | <input type="checkbox"/> Business English                            |
| <input type="checkbox"/> Industrial Management      | <input type="checkbox"/> Commercial Spanish                          |
| <input type="checkbox"/> Factory Management         | <input type="checkbox"/> Effective Speaking                          |
| <input type="checkbox"/> Banking and Finance        |                                                                      |

Name \_\_\_\_\_  
Present Position \_\_\_\_\_  
Address \_\_\_\_\_

## Answers to the Sam Loyd Tests on Page 43

### Jumping the Disks

**MARKER** No. 4 jumps to E, 3 jumps to A, 2 jumps to D, 1 jumps to B and 5 jumps to C, thus effecting the required formation of ten markers in line. Twenty minutes is fair time to do this trick in your head, ten minutes if you worked with actual markers.



### "Making Rows"

**THE** open circles illustrate placement of the three checkers to increase the number of rows of even total to sixteen—viewed horizontally vertically

and diagonally. Ten minutes gives you a high rating.

### A Test of Clear-Headedness

**STARTING** to the right from A, there are ten varied six-block routes to B. Also, there are ten varied routes with a downward start, so altogether there are twenty different routes between the two points. If you figured this out in fifteen minutes, you earned a high rating.



### "Pins and Areas"

**ARRANGED** as a right triangle, the twelve pins would inclose an area of six square inches. Turning in three of the corner pins, as shown, cuts two square inches from the area, so the remaining space is

equal to exactly four square inches. Fifteen minutes is a fair time.

### The Palindrome

**THE** palindrome that can be constructed from the thirteen letters is  
**WAS IT A CAT I SAW**

If you solved it in fifteen minutes, you earned a good rating.

### Farmer Wilkins' Cows

**FOR** the higher priced cow the farmer paid \$100, and he sold it for \$165, a profit of ten percent. For the other animal he paid \$50, and he sold it for \$45, a loss of ten percent. Therefore, he realized a profit of five percent upon his total investment. You earned a good rating if you solved this in eight minutes.

**ONLY ONE TWO-BILLIONTH** of the energy given off from the sun comes to the earth according to figures recently compiled by Dr. Paul W. Merrill astronomer at the Mt. Wilson observatory at Pasadena, Calif. The astronomer has also computed that an express train would take 800 years to reach the sun from our earth.



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Address \_\_\_\_\_  
Occupation \_\_\_\_\_  
Employed by \_\_\_\_\_

23rd Year

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## HYDRO Insured TIRES

are made by the only tire factory in America selling its own product through authorized representatives. We offer opportunity of lifetime to a high profitable business. No capital required. Make list and place in mail. Money loaned. \$1000.00. Write for start. We are looking for people and companies in connection with the Hydro Insured Plan.

**HYDRO-UNITED TIRE CORP.**  
Address Dept. 16 POTTSTOWN, PA.





## What will you be doing one year from to-day?

Three hundred and sixty-five days from now—what?

Will you still be struggling along in the same old job at the same old salary—worried about the future—never quite able to make both ends meet—standing still while other men go ahead?

One year from today will you still be putting off your start toward success—thrilled with ambition one moment and then cold the next—delaying, waiting, fiddling away the precious hours that will never come again?

Don't do it, man—don't do it.

There is no greater tragedy in the world than that of a man who stays in the rut all his life, when with just a little effort he could bring large success within his grasp.

Make up your mind today that you're going to train yourself to do some one thing well. Choose the work you like best in the list below, mark an X beside it, mail the coupon to Scranton, and without cost or obligation, at least get the full story of what the I. C. S. can do for you.

### INTERNATIONAL CORRESPONDENCE SCHOOLS Box 7612 E. Scranton, Penna.

Without cost or obligation, please send me one of your booklets and tell me how I can qualify for the position in the subject below which I have marked with an X.

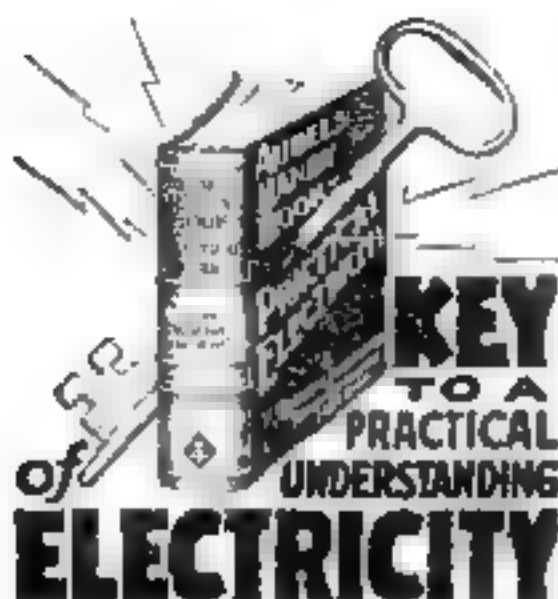
#### BUSINESS TRAINING COURSES

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| <input type="checkbox"/> Bookkeeping         | <input type="checkbox"/> Taxation             |
| <input type="checkbox"/> Secretarial         | <input type="checkbox"/> French               |

#### TECHNICAL AND INDUSTRIAL COURSES

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| <input type="checkbox"/> Mathematics            | <input type="checkbox"/> Science                   |
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| <input type="checkbox"/> Health                 | <input type="checkbox"/> Nutrition                 |
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| <input type="checkbox"/> Civil Engineering      | <input type="checkbox"/> Architectural Engineering |
| <input type="checkbox"/> Surveying              | <input type="checkbox"/> Mining                    |
| <input type="checkbox"/> Metallurgy             | <input type="checkbox"/> Ceramics                  |
| <input type="checkbox"/> Textiles               | <input type="checkbox"/> Leather                   |
| <input type="checkbox"/> Paper                  | <input type="checkbox"/> Glass                     |
| <input type="checkbox"/> Rubber                 | <input type="checkbox"/> Plastics                  |
| <input type="checkbox"/> Wood                   | <input type="checkbox"/> Metal                     |
| <input type="checkbox"/> Paint                  | <input type="checkbox"/> Ink                       |
| <input type="checkbox"/> Dye                    | <input type="checkbox"/> Pigment                   |
| <input type="checkbox"/> Color                  | <input type="checkbox"/> Light                     |
| <input type="checkbox"/> Sound                  | <input type="checkbox"/> Heat                      |
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Andel's Handy Book of Electricity, Price \$4.

A quick simplified ready reference giving complete instruction and inside information. Handy to use. Easy to understand. For Engineers, Professional Electricians, Students and all interested in Electricity. A reliable authority and a handy helper for every electrical worker.

### INFORMATION

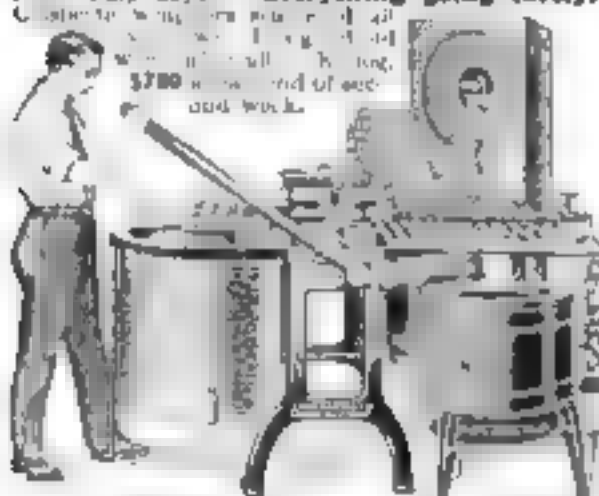
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## Is Your Home Lighted for Beauty and Comfort?

(Continued from page 135)

ward either from a central hanging fixture or from a series of tall floor pedestal lamps.

**T**HE the third lighting method which combines direct and indirect, is the most usual practice. It includes reading lamps, wall fixtures and luminaires in which light issues directly downward and is also reflected and diffused upward and around through shades, whether glass, parchment or silk.

"I've noticed that modern homes are doing away with central hanging luminaires," remarked the young woman.

"That is a fashion swing which lighting engineers say is a bad one," I replied. "They think fashion, in this case, doesn't jibe with the mathematical laws of light. For economy and good results, put the main light source at the center, but high enough not to bother the eyes. To equal the center light with wall bracket lamps means more current and more fixtures."

"Is it better to have an open bowl for the center light or the closed kind?"

"If you mean a bowl open at the top, an important thing to consider is its dust-catching proclivities. Between two fixtures of equal merit or attractiveness, always select the one that is easier to keep clean."

"That home lighting table I asked for at first," said persistent Ellen. "Isn't there a near-table at least that you can give us?"

"Yes, there is an offhand estimate of average requirements, disregarding paper panel and room size. Starting with the kitchen, you might install one 100-watt lamp in an enclosed bowl fixture, up against the ceiling in the center. Half that power might do in a small, light-painted kitchen. The dining room should have at least 100 watts in one or more lamps within a center hanging fixture, slanted to throw the light down on the table. A candleabra center fixture is second choice and may be preferred for looks, especially with harmonizing wall bracket lamps.

**T**HE living room needs a center light of more power than the dining room outfit and placed higher, so as to spread illumination. say 150 watts in one or more lamps. Add as many table lamps or reading fixtures as you like. They will be used more than the main luminaire, and each one may range from forty to 100 watts in power. For bedroom and bathroom a center lamp of fifty watts is often enough, with the addition of a bed reading lamp and twin bracket lights on either side of the dressing table or shaving mirror.

"Never light a mirror from above or from one side only. For an even job of tinkering a woman's complexion or straightening a man's face, have twenty-five to forty shaded watts on both sides.

"Pilot lights are useful to locate fixtures and to show your way about in a dark room. One of these small lamps uses the incredibly small current of one twentieth of a watt."



## \$1000 REWARD For the Capture of This Man

**C**ONVICT 6138, escaped from the State Penitentiary, Name, Charles Condray, age 37; Height, 5 ft. 8 in. Weight 141 pounds; Hair, light brown; Eyes, gray.

Easy enough to identify him from his photograph and this description, you may say—but, Condray took the name of "Brown", dyed his hair, darkened his skin, grew a mustache, put on weight and walked with a stoop.

Yet, he was captured and identified so positively that he knew the game was up and returned to the penitentiary without extradition. How was it accomplished? Easy enough for the Finger Print Expert. They are the specialists, the leaders, the crews of detectives. Every day a paper tells their wonderful exploits in solving mysterious crimes and convicting dangerous criminals.

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Get the big illustrated book on true Finger Printing cases now offered free. Also our special offer of a 100-page book, "Finger Printing in the Home" and a 100-page book, "Finger Printing in the Office" and a 100-page book, "Finger Printing in the Courtroom". The coupon is on the back of this report. You have everything to gain. Nothing to lose.

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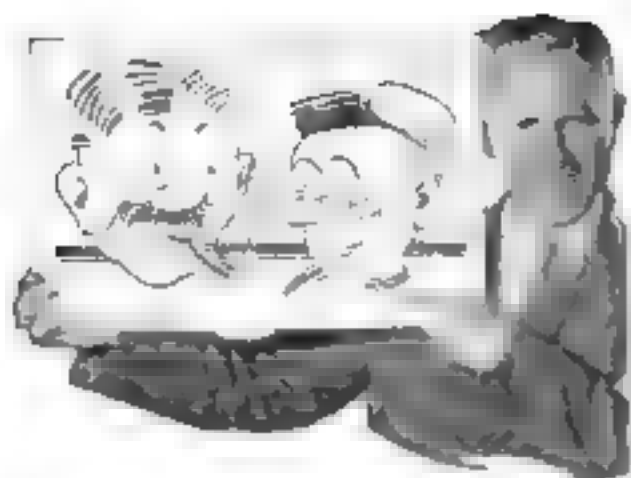
Gentlemen: Without any obligation whatsoever send me the confidential report on the future of finger printing and the 100-page book and special offer now open.

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## Here Are Correct Answers to Questions on Page 48

1. The oldest living trees are thought to be the famous giant redwoods in California. A number of these trees are 300 feet tall. Some of them have been cut down, and the annual growth rings in the wood indicated ages as great as 2,000 years.

2. The majority of storms that sweep across the country come from the northwest. They enter the boundaries of the United States either across western Canada or through the states of Oregon and Washington. Over the western part of the country the usual storm path is southeast. In the Mississippi Valley this changes. The path swings around toward the northeast, so that the storms leave the boundaries of the country somewhere in New England or New Jersey and pass out into the North Atlantic Ocean.

3. There are two kinds of food that are great heat producers for the human body. One of these is fat, the other is sugar. Since very little sugar is available to the Eskimos, their diet is composed largely of fat, which gives them the body heat they need.

4. This was a custom of the Aztecs in Mexico and of the earlier and greater people, the Mayas of Guatemala and Yucatan. Before the conquest of Mexico by the Spaniards, human sacrifices were made in the great Aztec temple of the City of Mexico, the victim being killed with a sacred knife made of sharp stone.

5. England is as far north as Labrador. It would have about the same climate were it not for the warming effect of the Gulf Stream. Anything that closed the channel through which the Gulf Stream flows north of Cuba might alter the course of the stream and make the British climate colder.

6. In Panama, Colombia and Venezuela, where a variety of ants cut fragments of leaves and carry them into their nests. On these leaves the ants deposit the spores of mushrooms. When the mushrooms grow, they are used as food for the baby ants.

7. The British Museum in London.

8. This term comes from the countries of Senegal and Gambia, West Africa, once prominent for the shipment of slaves to other parts of the world.

9. We are not certain whether the first boats large enough to be called ships were built by the ancient Babylonians or by the ancient Egyptians. About 700 years B.C., Pharaoh Necho sent an expedition by ship clear around Africa. As much as 1,000 years before this, ships were probably in use by the Egyptians. Models of the boats used on the Nile have been found in ancient Egyptian tombs.

10. In several countries, notably in India and in China, farm land is at such a premium that the natives have been driven to cultivate the slopes of steep hills. To keep the soil from washing off these slopes, the farmers build numerous small stone walls behind which the slopes are leveled into terraces. This makes a mountain slope look as though it were carved into the steps of a giant staircase.

11. Probably the ape-ape plant, that grows in the Hawaiian Islands. The leaves are shaped somewhat like the leaf of a common geranium, and are sometimes five or six feet across.

12. Probably the Hawaiian Islands. Botanists have found on these islands nearly 700 varieties of plants not found anywhere else. The reason is, apparently, that the islands are far from other land and have been isolated in this way for many geologic ages.



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This One



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# CONTENTS of This Issue

Editorial—An Idea of Your Own...	9
The World's Greatest Sky Taximan. <i>By Robert E. Martin</i>	9
Atomic Bullets Open Magic New Worlds to Us.....	12
<i>By Hyatt E. Gibson</i>	
Water or Dust May Run Our Cars	14
<i>By John E. Lodge</i>	
How the Movie Camera Lies.....	15
<i>By Sumner Smith</i>	
Do Our Athletes Equal Stars of Old?.....	18
<i>By Arthur Grahnne</i>	
Marvels We May See in 1927.....	20
"How Did You Get That Cold?"	23
<i>By Frederic Damrau, M.D.</i>	
Edison, at 70, Active While World "Catches Up".....	23
<i>By Alden P. Armagnac</i>	
Automobile Magic—How Your Car Is Built.....	26
The Mysterious Power of Music...	28
<i>By Edgar C. Wheeler</i>	
Home Owners Report Remarkable Oil Burner Results.....	30
He Speeded Up the World.....	31
<i>By H. C. North</i>	
Wanted—A Brand-New Calendar...	33
<i>By Frank Parker Stockbridge</i>	
More Picture Prize Winners.....	35
Is Your Home Lighted for Beauty and Comfort?.....	36
<i>By John R. McMahon</i>	
They Test Planes Now without Flying.....	38
<i>By G. H. Dacy</i>	
Strange Uses of Motorcycles.....	39
Science Blazes More New Trails...	40
Wonders of Everyday Things.....	42
<i>By Thomas M. Johnson</i>	
Try Your Wits at These Tests....	43
Brazilian Helps Us Fight Snake Peril.....	44
You May Drive Your Next Car Sideways.....	45
Novel Fire Escape Formed by Cable and Belt.....	46
Eight Minutes for Your Photo by Slot Machine!.....	47
Astronomers Check Up on Conti- nental Drift.....	48
Cardboard Doll Tests Machine Designs.....	49
Aviation's Advances at Home and Abroad.....	50
Miners Now Wash Gold from Sand by Machine.....	52
"Traffic as Usual" on a Moving Bridge.....	53
Acrobatic Auto Rolls Over Side- ways, Even Loops the Loop.....	54
Signals Stop Long-Winded After- Dinner Talks.....	55
Inventions to Lighten Household Tasks.....	56
How to Hook Up a Radio Set.....	58
<i>By Alfred P. Lane</i>	
What a Bargain Radio Did to Me. <i>As told to Newton Burke</i>	60
Hints for Radio Beginners.....	61
What's Wrong with the Captain's Car?.....	62
New Helpful Hints for Autoists....	64
The Home Workshop.....	67
Better Shop Methods.....	72
And More Than Two Hundred Other Articles and Pictures	



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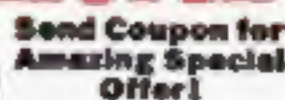
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**WISCONSIN HEARS COAST VOICES**—Madison, Wis., Aug. 24.—(AP)—The Wisconsin Legislature has Wednesday night on its agenda a bill to give the state a seat on the National Oceanic and Atmospheric Administration. Navy men here said the bill would give the state a seat on the National Oceanic and Atmospheric Administration. Navy men here said the bill would give the state a seat on the National Oceanic and Atmospheric Administration.

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in New York and California the  
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date the stations and they all seem  
to wonderful. Monte (Lille).

**HYACINTHS GROW UP WITH MEANS.** Portland, Texas, I tried three other yokes and the Mirco is the best of them all. Received KFLA, Los Angeles, Calif. on longwave, 12.11. Richard.

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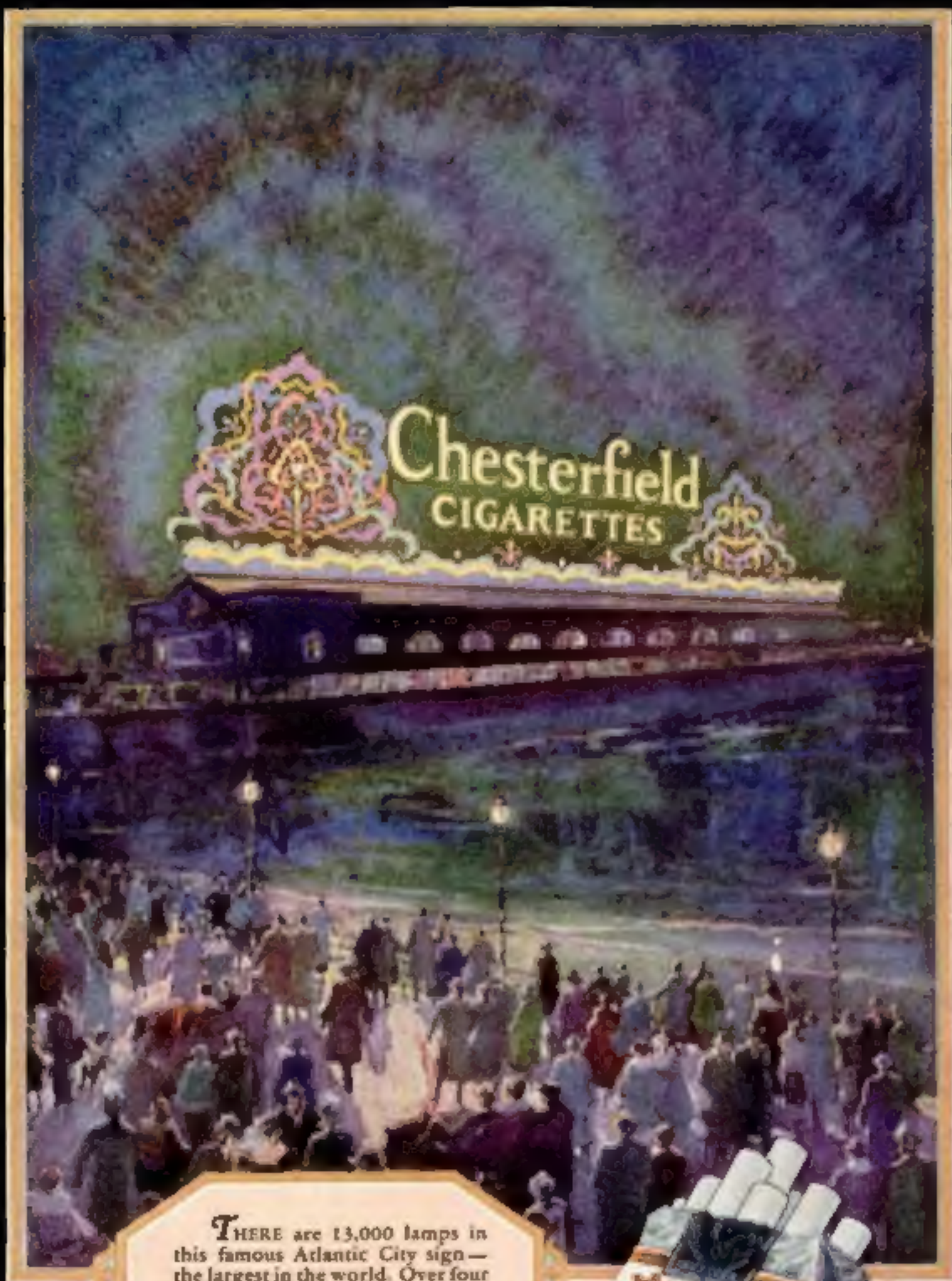
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